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BATTERY TO THE BRONX.

Thanks to the underground system, the traveler in New York can now go from the extreme southern tip of Manhattan Island far northward on the mainland, for the Battery and Bronx sections have just gone into operation. This is an immense step forward in knitting together the city and its suburbs, and it is to be hoped that the other underground electric roads aiming at similar purposes will soon be running also. The boon that electricity will thus confer on the population of this great center will be inconceivable, and will in some measure compensate for the shortcomings of the past and the discomforts of the present steam regime. That the Subway is not yet all that might be expected is natural, but so far no defect has developed that is not easily curable or that cannot be remedied in later tunnels. At its worst, the Subway even in this hot weather, is preferable to the New York Central tunnel, with its stifling steam, smoke and gases.

Just at this moment, moreover, the Long Island electric system is reported ready on one of the terminal sections, adding an important part to the work that will be completed only when the steam locomotive is banished entirely from the metropolitan region. On Long Island there will be connections of course with more tunnels, but all the work will be on main lines and branches, and in country presenting very few difficulties. There again the period of transition has been one of intense inconvenience for many of the residents, and Long Islanders and summer cottagers are suffering for their sins. It is obvious that no purchases of motive power or rolling stock adapted to the old regime can well be made at this juncture, so that when the change does come the contrast between a decrepit steam system and a modern electrical one is likely to be rather startling. But Long Islanders are quite ready for all the shock of that kind coming their way after these many years of a losing attempt to do profitably with steam a task for which electrical traction methods appear to be peculiarly and felicitously adapted.

USE OF ACETYLENE.

At the recent meeting of the Western Gas Association Mr. J. B. Morehead presented an interesting paper on calcium carbide and acetylene. While a large part of it was occupied by scientific and technical data already familiar to our readers in regard to the electrical production of calcium carbide, there were some points of novelty on the illuminating side of the subject. The increase in the number of acetylene town lighting plants is remarkable. In 1898, there were 4; according to Mr. Morehead there were 202 in 1904, and a number have been started this year. These plants, it is asserted, earn from 6 to 30 per cent on their cost; while incredible as it may seem, "the gas is sold at a price that is quite satisfactory to the consumers." Moreover, there are 80,000 isolated plants supplying from 10 to 2,000 burners, while "there are bicycle and automobile plants without number, and several thousand table lamps supplying a magnificent reading light."

All this goes to show that a new illuminant can make its way on merit, and that acetylene has approved its place in the world of utility. Aside from the fact that calcium carbide owes its present prominence to electricity, twenty to forty thousand horse-power being employed in this country alone in its production, there is the

question of its effect on electric lighting; and we are sure all of our electric lighting friends will admit that it is a good stiff competitor, with distinct advantages of its own, even conceding all the possible disadvantages. The discussion of the paper would intimate that all the gas managers are not convinced as to its benefits as an enricher or in any other way, but the figures cited by Mr. Morehead are eloquent as to general adoption and recognition.

AT THE END OF A WIRE.

Hitherto a juryman has been supposed to be a being cut off from the rest of humanity and isolated like some pestilence breeder or dangerous wild beast. He has been separated from his business and family, subjected to pecuniary loss, compelled to plunge his mind and soul into the details of revolting crime or chicane, and expected to find consolation in the jokes from the bench and the dreary imbecilities of the bar. As he is thus supposed to be assisting at the trial of one of his "peers," he is naturally put just about on the level of the said peer, and then is told it is all necessary as part and parcel of the glorious system of trial by jury—a system which, as it stands, is one of the most intolerable relics of barbarism known to modern jurisprudence and humane civilization.

There now promise some mitigations, however, due to the aid of electricity, and we are glad to note that recently a New York judge permitted an anxious New York broker to get the varying quotations of cotton, as he sat sweating and fuming in the jury box. This is a new departure, without precedent, we fancy; and one which if pushed further might reconcile many good men to the regular performance of a task that they long since ceased to regard as a duty or privilege. If every jury box could be fitted up with stock tickers, telephones and messenger calls, there is no doubt that the jury panels would be crowded with desirable recruits and the dispensation of justice would go on with celerity and dispatch. For the poor juryman, besides keeping him in touch with his vital affairs of society and finance, it would come as a welcome relief to the monotony of dreary charges from the bench, the pitilessly prolonged cross-examination, and the dull drone of befuddling counsel. And it is safe to say that the average wisdom and fairness of jury decisions would at least be quite as high as it is today.

Aside from this aspect of the case, or this extreme presentation of needed reform, a halfway measure might be adopted in the general equipment of court houses and court rooms with telephones. Many of the halls of justice in New York are without these essential necessities of modern life, and we believe it is true also of other cities that they are equally behind the times.

THE INTERNATIONAL ASPECTS OF WIRELESS.

Recent work in wireless telegraphy brings very sharply into view questions that were raised in the early stages of the Russo-Japanese war. A few weeks ago it was announced that one of our warships off Cape Cod had been in communication with another anchored some five hundred miles away near Fort Monroe, and about the same time several liners kept in touch with messages from one side of the Atlantic or the other throughout the entire voyage. Compared with this, the work of a year ago seems tame, and the international relations of the system take on a new significance. The problems of wireless in the current war have been two: First, what is the status of a neutral vessel, such as a press boat, using wireless to forward to neutral territory information about a belligerent? Second, what are the responsibilities of a neutral power with respect to the use of its territory as a wireless base for a belligerent? As we intimated at the time of the original discussion, the former question is a fairly simple one. It is both bad manners, and bad judgment, to intrude, quite uninvited, upon the zone of actual hostilities on sea or land. A neutral caught with a wireless outfit between two armies is inferentially a spy, and would be lucky indeed if he could so persuade his captors of his innocent intentions as to escape summary execution. On the high seas, there are as yet no well defined principles for dealing with spies, but there is ample precedent for the summary seizing of neutrals whose escape might lead to dangerous information reaching the enemy, and the greater the facilities of a neutral for obtaining and disseminating information the sounder cause there is for such action.

In short, so far as the action of neutrals in seeking upon the high seas, and disseminating, information as to the movements of belligerents is concerned, it is a case of taking long chances; and it is safe to say that if Togo had found a press boat with a wireless outfit nosing about his base in the Straits of Korea, that boat would not have been heard from again for some considerable time. With respect to land operations, the use of Chinese territory as a wireless base for communication with Port Arthur involved different and much more troublesome questions, which need to be settled by international convention. If Chinese neutral territory had extended within easy sight of the besieged fortress and the Russians had organized a heliograph service with a station in that territory, there can be little doubt that China would have received some pretty sharp admonitions, and for just cause. It seems to us that a wireless telegraph station installed for a like purpose should fall in exactly the same category. So far so good, but in view of the present state of the wireless art far more troublesome possibilities arise. Suppose that there had been at Wei-hei-hei, for instance, a commercial wireless station regularly doing business with other stations along the coast and with passing shipping. And suppose further that this station had sent and received code messages in the ordinary course of its business, really involving systematic communication with Port Arthur. Would thereby any responsibility lie against Great Britain or any other neutral nation owning an offending station? When wireless messages can be sent clear across a belligerent country there are immense chances for acts unfriendly, if not openly in violation of neutrality.

If wireless telegraphy had been in use, for example, during the Franco-Prussian war, it would have been no difficult matter to have kept up communication with London from every besieged fortress, and while the besiegers would have tried to block all messages, they probably could not have succeeded without also intercepting legitimate messages to neutrals as well. Assuming that interception would be possible, would a belligerent be justified in wholesale interference with neutral ether in the endeavor to suppress "improper" communications? A cable can be quietly cut and nothing said, or due apologies made for the mistake, but perhaps the ethereal cable cannot be cut at all or only at cost of strenuous and obvious efforts. At all events, there exists the certainty that in any future war, new and grave responsibilities will fall upon conscientious neutral powers as regards the conduct of wireless stations in their territory. It is an entirely novel situation, and the ordinary precedents cease to have any direct value. If syntonic working should be perfected, the complications would become even graver. There would be practically an invisible network of cables embracing alike the territory of belligerents and of neutrals, either to be regulated in its international relations or taken as one of the unavoidable incidents of war. But from whatever standpoint the subject be viewed, it is clear that there should be some general convention covering the

matter. We look with distrust on projects that tend to make wireless telegraphy a government monopoly, and even governmental regulation, in the commercial sense, we are disposed to view askance. It has become pretty clear, however, that when a number of persons utilize simultaneously the common ether in such wise that they interfere with one another, it is high time for legal definition of their respective rights and duties. And when the interfering parties include those of divers nationalities, belligerents and neutral, the case has passed out of the exclusive jurisdiction of any one country and becomes a necessary subject of international agreement. It is time that this was considered seriously, for every month tends to increase its complications and to make a just settlement more puzzling and difficult.

CONSTANT-VOLTAGE, VARIABLE-SPEED DYNAMOS.

One of the earliest attempted applications of the electric lamp was to the illumination of railroad trains; but the problem has proved to be a difficult one. If the dynamo is mounted on the locomotive, it calls for a certain amount of care, and this the driver is loath to afford in view of graver duties. If it be mounted under a car, and driven by the car axle then the locomotive driver is happy, but the car's troubles begin. The car has to travel thousands of miles, perhaps, without any skilled attention for the dynamo. This must run for weeks together without inspection and without getting out of order in spite of dust, mud and much jolting. It is usually necessary to install an auxiliary storage battery to keep the lamps alight during train stops and slow-downs. This means that there must be a switch to disconnect the dynamo from the battery whenever the train speed falls below a certain minimum. The switch must be above suspicion as to the faithful performance of its duties. Nevertheless, automatic switches rebel occasionally, and go on strike, when the dynamo man is away. Even when the automatic switch is innocent, unless it be made fool-proof or inaccessible, an irresponsible passenger, or trainman, will probably abuse it. For all the above reasons, and many others, the path of the designer of a train-lighting dynamo is not bestrewn with roses. Nevertheless, there are several well known train-lighting systems which have stood the test of practical experience. All of these are characterized by simplicity. No complicated system of regulators can stand the severe conditions of railroad operation. A new form of train-lighting dynamo, prepared by Dr. E. Rosenberg, is described on page 104 of this number. It presents a number of interesting features. Although shunt-wound, it bears resemblance to various series-wound constant-current arc-lighting dynamos. In the ordinary constant-potential, direct-current dynamo, armature reaction is a bugbear, and its effect is minimized by employing a powerful main-field excitation with as much reluctance as possible in the armature cross-field. But, according to the proverb that what is one man's meat is another man's poison, armature reaction is utilized and relied upon in the constant-current series dynamos above alluded to. The main-field excitation is weakened in these, and the cross-field strengthened in such a manner that the working e.m.f. is often due more to the excitation of the armature than to the excitation of the field.

In the Rosenberg dynamo the working e.m.f. is due entirely to armature reaction. He takes a shunt dynamo with a high reluctance in the main magnetic circuit and a low reluctance in the cross magnetic circuit. Then he comfortably puts the armature on a dead short-circuit, by connecting its brushes through a heavy cable. If the dynamo were kept powerfully excited, an enormous current would flow through the short-circuited armature. But a very moderate strength of current in the short-circuit is sufficient to produce powerful armature reaction, or a large cross-field. Under these conditions, a pair of brushes applied to the commutator at the perpendicular diameter, will pick up a goodly e.m.f. generated entirely by the cross-flux. This e.m.f. supplies the load of car lamps or storage battery. The load current produces a c.m.m.f. immediately opposing the shunt field m.m.f. and weakening thereby the main flux. Consequently, the machine settles down into a condition of magnetic equilibrium, whereby there is just enough resultant main flux to produce the necessary short-circuit current in the armature, to produce in its turn the cross-field necessary for generating the required cross e.m.f. and load current. If the load current falls off, the c.m.m.f. which it produces also falls off. This brings up the main flux, the short-circuit current in the main armature path, the cross m.m.f., the cross flux, the cross e.m.f. and the cross or load current. On the contrary, if the load current becomes too great, the c.m.m.f. thereby produced in the field-magnet circuit becomes large enough to weaken seriously the main flux. This weakens the main e.m.f., the main armature current of short-circuit, the cross m.m.f., the cross flux, the cross e.m.f. and the cross or load current. The automatic regulation, effected in the load current as above, involves constant voltage, if the load is constant, or substantially so, as in car lighting; so that the dynamo is enabled to maintain nearly constant voltage and current in its load circuit under a wide variation in speed. According to the curves and data given, the speed of the car may vary from 20 to 65 miles per hour without producing more than about 12 per cent change in voltage at storage battery terminals. The advantage of the plan is the absence of all moving mechanism or rotating regulators. There remains only the automatic main switch to cut off the dynamo when the speed falls below, say, 15 miles per hour.

Alternators are compensated for terminal voltage by varying the armature reaction in their exciters in accordance with changes of load, and constant direct-current arc light dynamos are regulated, as above mentioned, by their armature reaction; but this is the only shunt direct-current dynamo regulated by its own armature reaction so far as we are aware. Another way of regarding the actions which occur in the armature, is by noting the direction of the resulting flux in the armature at constant load and varying speed. At very high speeds, the resultant field is weak and the angle of distortion large. At low speeds, the resultant field is stronger and the angle of distortion smaller. The tangent of the angle of flux distortion seems to be proportional to the speed; but at an indefinitely great speed, the resultant flux becomes vanishingly small. The short-circuit current through the armature is stated to be only 40 per cent of the load current at normal speed; so that at high speeds the short-circuit current becomes trivial. At low speeds, on the other hand, the current in the short-circuit path is augmented, for this is the real exciting current, and the excitation must be increased to compensate for the low speed. The lower the speed at which a dynamo of this kind has to work, the harder appear to be the conditions of design. At first sight it would seem impossible to apply an extra pair of brushes on the commutator at a diameter perpendicular to the normal neutral diameter. The armature coils short-circuited under the extra brushes are in the strongest part of the main field and are, therefore, likely to develop powerful local short-circuit current. To remedy this difficulty, deep slots are cut in the centres of the field-poles at the places where the extra brushes are applied. In this way an artificial neutral diameter is provided for the extra pair of brushes. In a similar manner it should be possible to apply extra brushes to the commutator of an ordinary shunt-wound dynamo, in order to feed a three-wire system, or even a five-wire system. Whatever may be the industrial success of this particular train-lighting dynamo—which is not the question here—the lessons gained from its tests and behavior should be of value to electrical engineers and dynamo designers.

Electrical Exhibition and Contractors' Convention.

Some details have already been given in these pages of the electrical exhibition that is to be held in Boston in connection with the fifth annual convention of the National Association of Electrical Contractors have been perfected. The exposition will open in Mechanics' Building, Saturday evening, July 15, with a musical programme by Reeves' American Band, which will also give concerts throughout the week. A large and efficient reception committee will be at headquarters and will meet the specials due from New York and the west. The opening session of the convention on Wednesday will be a notable event. Addresses of welcome will be delivered by F. L. Barnes, president of the Massachusetts State association; by Governor Douglas in behalf of the State, and Mayor Collins in behalf of the city. F. McCleary, of Detroit, Mich., president of the National Association, will then deliver the annual address, after which will come addresses and topics as follows: "The Electric Contractors' Association," by Charles L. Eidlitz, of New York, ex-president of the National Contractors' Association, and ex-president of the Building Trades Association of New York; "The Jobbers," by A. L. Gorman, of New York, general manager of the Manhattan Electrical Supply Company; "The Manufacturers," speakers to be announced; "The Underwriters," by F. E. Cabot, of Boston; "The Relation of Inspector and Contractor," by P. J. Kennedy, of Boston, commissioner of wires. There will also be other prepared addresses and general discussions.

An executive session of the National Association will be held Wednesday afternoon, July 19, and the annual dinner to the members of the National Association will be given in the evening. Thursday forenoon will be devoted to a session of the association and at 2:30 p.m. delegates and guests will embark at Rowe's Wharf for a steamer trip down the bay, dining at the Rockland House, Nantasket, and visiting Paragon Park in the evening. Friday will be devoted to executive sessions of the National Association and Saturday will be given up to sight seeing and entertainment.

A ladies' committee of thirty has been appointed to have charge of the entertainment of the lady guests of the association. Concord, Lexington, Bunker Hill, Harvard College and other historic and interesting places will be visited and an extended auto trip will be taken along the picturesque North Shore. Side trips for sight seeing and shopping will be made daily. Delegates have already been reported from 39 States.

Following is a list up to date of those exhibitors who have secured space: American Electric Novelty Manufacturing Company, New York; American Circular Loom Company, Chelsea, Mass.; *American Electrician*; American Electric & Controller Company, American Electric Sign Company, Boston; Automatic Electric Train & Station Annunciator Company, Lexington, Mass.; Appleton Electric Co., Bridgeport, Conn.; Booth & Co., Boston; Bryant Electric Company, Bridgeport, Conn.; Benjamin Electric Company, New York; Bova, L. E., Boston; Couch & Seeley Co., Boston; Cotton, Chas. A., Boston; Chase-Shawmut Company, Boston; Condit Electrical Mfg. Company, Boston; Dale Company, New York; De Veau Telephone Company, New York; Dossert & Co., New York; Delaware Hard Fibre Company, Wilmington, Del.; Dorn, Philip, Boston; Electric Gas Light Company, Boston; Economical Electric Lamp Company, New York; Eastern Carbon Works, Jersey City, N. J.; Electro-Dynamic Company, Bayonne, N. J.; Edison Electric Illuminating Company, Boston; Eastern Electric Cable & Wire Company, Boston; ELECTRICAL WORLD AND ENGINEER, New York; *Electrical Review*, New York; Elm City Engineering Company, New Haven, Conn.; Erickson Electric Equipment Company, Boston; Forg, Peter, Somerville, Mass.; Felkin, A. C. & M. L., Boston; Gleason, John L., Jamaica Plain, Mass.; General Electric Company, Schenectady; Gould Storage Battery Company, Boston; Greenwood & Daggett Co., Boston; Holmes Manufacturing Company, New York; Harvey Hubbell, Bridgeport, Conn.; Hill, W. S., Electric Company, New Bedford, Mass.; Johnson & Morton, Utica, N. Y.; Johns-Manville Co., H. W., New York; Knowles, C. S., Boston; Lowell *Daily Mail;* McKenney & Waterbury Co, Boston; Mullen, Colman J., Brooklyn, N. Y.; Manhattan Electrical Supply Company, New York; Minimax Company, Boston; Marshall Electric Manufacturing Company, Boston; Mietz & Weiss, through Frank A. Davis, Boston; Miller Anchor Company, Norwalk, O.; National Carbon Company, Cleveland, Ohio; Ovington Manufacturing Company, Boston; Pass & Seymour, New York; Pettingill-Andrews Co., Boston; Proctor-Raymond Manufacturing Company, Detroit, Mich.; Poole, J. W., Columbia Street, Boston; Renim Specialty Company, Boston; Ridgeway Dynamo & Engine Company, Boston; Roebling, John A. Sons Co., New York; Steel City Electric Company, Pittsburg, Pa.; Safety Armorite Company, New York; Sprague Electric Company, New York; Smith Premier Typewriter, Boston; Swazey & Smith, Boston; Stuart-Howland Company, Boston; Simplex Electric Company, Boston; Starbuck Sprague, Boston, Mass.; Street Railway Bulletin, Boston; Trumbull Electric Manufacturing Company, Plainville, Conn.; Underwood Typewriter Co., Boston; Valentine Electric Sign Company, Atlantic City, N. J.; Westinghouse Electric Manufacturing Company, Boston; White, O. C., Co., Worcester, Mass.; Wireless Railway Company, Philadelphia; Y. M. C. A., Boston; Worcester Electric & Mfg. Co., Worcester, Mass. Mr. Chester I. Campbell is the manager of the exhibition.

Committees of the Western Electrical Inspectors.

A bulletin of the Western Association of Electrical Inspectors calls attention to the special committees appointed for the purpose of dividing up the work The classification of duties as thus revealed is of interest. The substance of the bulletin is given below:

The Committee on Uniformity in Rulings shall decide all questions relating to the interpretation of the National Electrical Code concerning which there is a general difference of opinion. It shall promulgate to each member of the association its decision on the question submitted and if approved by a two-thirds vote of all members the decision shall be considered as sustained and binding upon the association membership.

The Committee on National Electrical Code shall receive and prepare for submission to the association all proposed amendments to the National Electrical Code which are to be forwarded in the name of the association to the Electrical Committee of the Underwriters' National Electric Association for consideration at the annual meeting held in December of each year. This committee shall be charged with the responsibility of securing the adoption of such amendments as are approved by the association, when the same are up for consideration at the December meeting of the Electrical Committee of the Underwriters' National Electric Association.

The Committee on Outside Wiring shall have charge of all questions concerning the hazard to life and property involved in outside wiring, and it shall be the duty of this committee to formulate plans and specifications which if followed will eliminate much of the confusion which now exists where overhead conductors are employed.

It shall also report to the association the details of such accidents as come to its notice, arising from defective outside wiring, together with remedies calculated to prevent a recurrence of similar accidents.

The Committee on Theatre Wiring and Show Equipment shall prepare detailed specifications for the installation, maintenance and operation of electric wiring and apparatus used for theatrical purposes.

The Committee on Grounding of Conductors for Safety shall prepare supplementary instructions for the grounding of conductors as contemplated in the National Electrical Code. It shall also be the duty of this committee to prepare for presentation to the members of this association a concise explanation of the hazard to be eliminated by grounding.

The Committee on the Construction and Installation of Electric Signs shall prepare instructions for building, hanging and wiring of electric signs.

The Committee on Show Window and Display Lighting shall prepare instructions for the safe installation of wiring and apparatus used in show windows or for displays of a temporary character, together with suggestions for window trimmers or others engaged in the arrangement of merchandise for exhibition in the vicinity of electric lights, wires or apparatus.

The Committee on Instructions to the Public Concerning the Safe Operation and Maintenance of Electric Wiring and Apparatus shall prepare a simple set of instructions which shall be suitable for distribution to the public, covering the common abuses to which

electric wiring and apparatus is subjected and the consequent hazard involved.

Committee on Laws and Ordinances shall draft bills and ordinances for submission to city councils, State Legislatures, etc., covering the electrical hazard, and shall assist in the enactment and enforcement of such laws and ordinances. It shall also be the duty of this committee to prepare a simple system of office records, blanks, etc., suitable for the use of municipal or insurance electrical inspection departments.

Development of Telephony in Mexico.

It is announced from Boston that the operations of the Mexican Telephone & Telegraph Company, the reorganized Mexican Telephone Company, will show that earnings for the twelve months will approximate $167,000 as compared with $139,000 a year ago. For the quarter ended May 31, earnings were as follows:

	1905.	1904.	Changes.	
Gross	$76,826	$71,854	Inc.	$4,972
Expenses	35,027	39,808	Dec.	4,780
Net	$41,799	$32,046	Inc.	$9,752

About 62,000 shares of the Mexican Telephone Company have been deposited for exchange under the reorganization, whereby the holder of nine shares of the old stock receives one share preferred and two common in the new company, par in every instance $10. Of the old company there were 810,000 shares outstanding.

The new management is desirous of dissolving the old company, but is finding some difficulty, as under the New York laws it is necessary for dissolution to present to the State the written consent of two-thirds of the outstanding stock. Slightly less than $350,000 is being spent by the company for additions, extensions and improvements, etc., in Mexico. Under concessions granted by the Mexican Government recently for 30 years, the company was obliged to remove aerial wires in the "limited zone" in Mexico City and place them in conduits. This work has already been commenced and 100,000 ft. of cable has been laid. The company is installing in that city a new common battery switchboard with an ultimate capacity of 7,000 connections. When placed in operation, however, it will be equipped for 3,000. In that instance alone the expense is estimated at about $300,000.

At a cost of about $20,000 the company has installed in its new Monterey office a new switchboard large enough for 1,200 connections. There as well as at Tampico the metallic service is also being placed in operation. In the other 15 cities in which the company operates minor improvements have been made or are in contemplation.

Municipal Plant for Ashland, Ore.

At a meeting of the City Council of Ashland, Ore., held June 21, an ordinance was passed to install a municipal electric light and power plant, to be operated by water power. A city election will be held to vote on issuing $50,000 city bonds to pay for installing said plant. Five of the bonds are to fall due September 1, 1910, and five each year thereafter. On June 10 it was decided by a city election (there being only nine dissenting votes) to issue $30,000 bonds for the purpose of purchasing all the water rights of Ashland Creek not now owned by the city. Both issues of bonds will bear 4½ per cent interest, payable semi-annually. The last-named issue will run for 15 years.

The laying of a complete sewer system is now well under way. The city has for years owned its own gravity water works. The water is supplied by a cool mountain stream, which has its source in the timbered, snow-capped Ashland peak (which is wisely protected by the Ashland Forest Reserve), situated about seven miles distant, to the south, up Ashland Creek Canyon.

As soon as the 500-hp. electric generating plant is installed near the head of the said canyon above the intake of the city water the water will flow directly into the principal main of the city water works, 650 ft. above the city. The mayor of Ashland is Hyrum S. Evans.

What is Electricity?

A very interesting article, bristling with interrogation points, is contributed by Prof. A. E. Dolbear to the *Popular Science Monthly* for July, dealing with the science problems of the twentieth century. It discusses the live issues in each domain of science and intimates the scope and importance of the pressing problems in each. One or two passages may be here quoted. In regard to chemistry, Prof. Dolbear remarks: "We say 'chemical energy,' but we have no idea how it differs from heat or from gravitative energy. It is a mystery. What form of motion or stress can be thus embodied? In some way it is related to the ether. It seems as if in some unique manner atoms drew from the ether as from a common reservoir, each particular atom capable of holding so much of that kind and no more, like pint cups and quart cups, and this at once transformed into heat at the instant of combination. When combinations of atoms such as water are decomposed, they again absorb the energy spent to separate them, and an atom, therefore, possesses more available energy than any combination of atoms. It seems as if atoms acted as transformers of ether energy into the ordinary and familiar forms, such as heat and electricity, and vice versa, transforming the latter into ether energy. When we learn this secret we may likely enough be able to artificially extract from the ether as much energy as we need for any purpose, for as I have said, it is inexhaustible, and every cubic inch of space has enough for all the needs of a man for many days. This seems fairly probable, and when the source of atomic energy is discovered, it will rank with the greatest scientific achievements of all time. We shall know more of the ether, of the structure of matter, of the antecedents of most of the energy we are familiar with, as this phenomenon underlies most if not all of the phenomena in all the sciences. It is yet regarded as a mechanical paradox that a medium without friction should have waves set up in it by molecular vibration, and little is known of the physical relations existing between matter and ether by which electrical and magnetic phenomena are produced, and one may say that of the nature of ether we know nothing. Think of the amazing extent of it. As limitless as space itself, with no break or separation of its parts, not made up of particles like matter, but completely filling space and so constituted that any movement of a particle of matter in some way affects the whole body of it to the remotest part of the visible universe."

Coming to the all-embracing mystery of electricity, Prof. Dolbear says: "Here on the threshold of the new century we are confronted with the question 'What is electricity?' and the answer implied by the question seems to demand a something which could be described by one who knew enough, as one would describe some new mineral or gas or thing. Some eminent scientific men are befogged by the question, say it is some ultimate unknowable thing, and hopeless as an inquiry. If it be a something it must be described by its constant properties as other things are. If it be unlike everything else then it cannot be described by terms that apply to anything else. All material things have some common properties. A glowing coal is an incandescent solid, a flame is an incandescent gas, but neither glow nor flame exists apart from the matter that exhibits the phenomena. Both are conditions of particular kinds of matter. If electric phenomena are different from gravitative or thermal or luminous phenomena it does not follow that electricity is miraculous or that it is a substance. We know pretty thoroughly what to expect from it, for it is as quantitatively related to mechanical and thermal and luminous phenomena as they are to each other; so if they are conditions of matter, the presumption would be strongly in favor of electricity being a condition or property of matter, and the question 'What is electricity?' would then be answered in a way by saying so, but such an answer would not be the answer apparently expected to the question. To say it was a property of matter would be not much more intelligible than to say the same of gravitation. At best it would add another property to the list of properties we already credit it with, as elasticity, attraction and so on. In any case the nature of electricity remains to be discovered and stated in terms common to other forms of phenomena, and it is to be hoped that long before this new century shall have been completed, mankind will be able to form as adequate an idea of electricity as it now has of heat." Prof. Dolbear intimates in his article the belief that the field of investigation and research remains as large and fruitful as it has ever been.

Fessenden Wireless Telegraph System.

A budget of eight patents containing a total of 109 claims was issued on July 4 to R. A. Fessenden for improvements in wireless telegraphy. These patents deal with all of the constructional details of a system for signaling by electromagnetic waves, and disclose several distinctly novel features. One of the patents relates to that form of receiver called the "liquid barretter," as illustrated in Fig. 1.

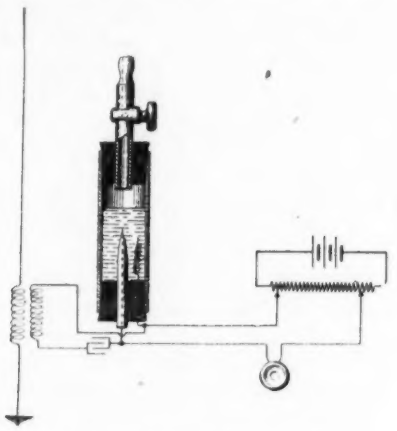

FIG. 1.—LIQUID BARRETTER.

The receiver consists of a glass tube containing a solution of nitric acid or caustic soda. A fine wire terminal is immersed in the solution. The oscillatory currents to be detected and a constantly flowing current from a local source both flow through the constricted conducting fluid path; and the oscillatory currents produce a change in the amount of current flowing through the local circuit. The present invention refers specifically to the use of a pressure on the liquid above atmospheric pressure so as to increase the loudness and clearness of the signals obtained in the telephone receiver. The inventor states that very good results have been obtained with pressures as high as 40 or 50 pounds per square inch.

Two of the patents relate to condensers. In one of these the inventor suggests the use of short lengths of cables such as are used for high-voltage power transmission circuits, the advantages being that the condenser is not subject to heating, is little affected by hot weather, has very small losses, is very conveniently arranged, is readily repaired in case of damage, and is comparatively inexpensive. Another form of condenser is that illustrated in Fig. 2,

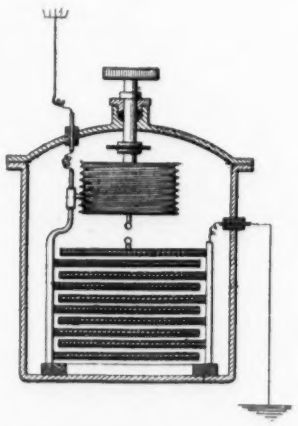

FIG. 2.—COMPRESSED GAS CONDENSER.

in which the dielectric is compressed air. The great fact in the efficiency of compressed air condensers is that at a pressure greater than about 60 pounds per square inch, the static discharge and its accompanying loss of energy, which may amount to 50 per cent in air at ordinary pressures, seems to disappear entirely. The inventor states that with plates one-twelfth of an inch apart under a gas pressure of about 175 pounds per square inch, when the potential is raised to 27,500 volts, there is no apparent loss of energy, while at 28,500 volts a spark passes between the plates; and that it is practicable to make condensers of reasonable size and cost and having a higher efficiency than condensers with any other dielectric. With the air condenser there is no dielectric hysteresis or brush discharge, and apparently no loss of any kind, and almost any degree of resonance appears to be obtainable by its means. The period of oscillation and hence of the frequency of the wave produced, appears to remain absolutely constant irrespective of the temperature and other conditions, so far as can be measured; that is, to within about one-tenth of one per cent as determined by the hot-wire barretter.

The subject of aerials is treated in two patents. For permanent land stations there is described an aerial consisting of a cylindrical structure insulated at the base from the ground and provided at the top with a collection of wires radiating from the aerial. By using cylindrical sections of suitable diameter a great height may

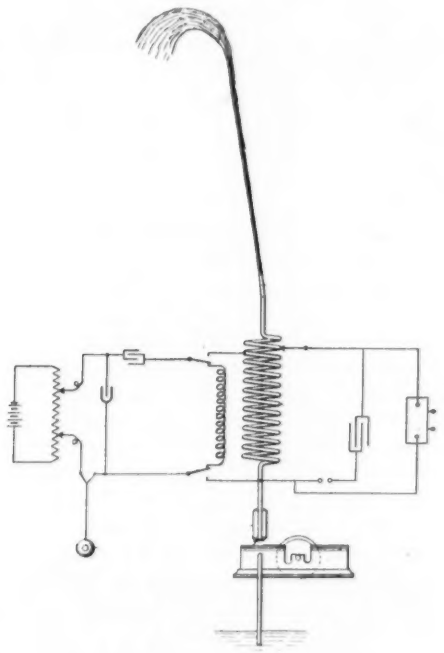

FIG. 3.—LIQUID AERIAL.

be obtained. Provision may be made for access to any part of the aerial by an internal ladder. A water jet aerial is shown in Fig. 3. This type is intended for use on board ships where the masts have been shot away, or where long distances are required on fortifications at which a permanent mast is not desired.

Three patents relate to the general subject of signaling by electromagnetic waves. According to one of these, the inventor suggests as the initial source of energy an alternating-current generator with which is employed a condenser that may be placed in operative relation alternately to the generator and to the aerial. A commutator driven synchronously by the generator is used for interchanging the connections of the circuits as desired. Two of the patents relate rather to wireless telephony than to wireless telegraphy. Broadly considered, the method employed consists in the practically continuous generation of electromagnetic waves and in modifying the radiations without interrupting their continuity. Numerous methods are proposed for using the sending and receiving telephone apparatus. According to one method, there is employed a dynamo capable of producing directly in the sending conductor the desired wave frequency—as, for example, a dynamo having frequencies up to 300,000 per second, and capable of radiating several horse-power. A telephone transmitter is inserted in the field circuit of the dynamo. On speaking into the transmitter, the field strength of the dynamo will be varied, and the intensity of the radiation from the sending conductor will vary to correspond with the tones of the voice. The usual telephone receiver equipment is used at the receiving station. The capacity effects which are so prejudicial to good speed in cable telephony are absent in the transmission by electromagnetic waves, and the higher harmonics of the voice are transmitted without distortion, resulting in extraordinary clearness of articulation. The inventor states that there is not the slightest doubt that the transmission of speech across the ocean is quite possible by this means.

The Ontario Power Co. Begins Operations.

On July 1 the Ontario Power Company, of Niagara Falls, for the first time applied potential to its 60-000-volt transmission lines. Work was begun upon this development of 200,000 e.hp in March, 1902, something over three years ago. On June 15 water was admitted to the intake works, now completed for the full capacity, and on June 22 the first 10,000-hp. unit, generating three-phase, 25-cycle current at 12,000 volts, was put in motion. The first set of step-up transformers to raise the potential from 12,000 to 60,000 volts, each of 2,500 kw capacity, oil-insulated and water-cooled, was put in service on July 1. The permanent transmission line, at present only partially completed, consists of duplicate lines of 49-ft. tripartite steel towers, carrying porcelain insulators of a new type on iron pins, and aluminum cables nearly an inch in diameter. The average length of span is 550 feet. The present expectation is to have three units, with a total capacity of 30,000 horsepower, delivering power by the last of September.

Utilizing Water Power on Vancouver Island.

Mr. L. E. Dudley, U. S. Consul at Vancouver, British Columbia, gives this interesting account of water power development on Vancouver Island: "The great engineering enterprise undertaken by the British Columbia Electric Railway Company (Limited) to furnish electric power is now approaching completion. About 16 miles from this city there is a small lake covering about 300 acres. This is called Trout Lake, or Lake Beautiful, and lies about 400 feet above the high-water mark. A power plant has been established at the foot of the mountain, and water is brought down in large pipes, having a fall of 390 feet in 1,600 feet. But this lake does not contain sufficient water to meet the demands in the dry season, and therefore it was decided to bring down the water of Lake Coquitlam, which lies about 35 feet higher than Lake Beautiful and has an area of about 2,000 acres. Between the two lakes there is a range of mountains rising to a height of about 4,000 feet, and to bring the water from Lake Coquitlam to Lake Beautiful required the construction of a tunnel almost the entire distance, some two and one-half miles, through solid rock.

"Work was begun about two and a half years ago at both ends, and continued until a few days since, when two gangs of men met in the middle of the tunnel. Sufficient water has thus been secured to produce all the electrical power that is likely to be needed in this vicinity for many years.

"The tunnel is regarded as one of the largest and most successful engineering enterprises yet undertaken in this province, and the following are facts concerning it: Cost, $320,000; total length, 2½ miles; size, 9 by 9 feet, with rounded corners; area of normal cross-section, 73 square feet. The consulting engineer was Mr. Wynn Meredith, an American, who has been employed upon great works at several points in the United States."

Production of Artificial Graphite.

The U. S. Geographical Survey publishes a monograph by Mr. J. H. Pratt, on the production of graphite in 1904. The following passage relates to artificial graphite, now largely made by electricity: The production of artificial graphite has been steadily increasing since its introduction upon the market in 1897, and in 1904 there was a very large increase in the production as compared with that of 1903. This is due to its being introduced into the manufacture of other graphite products besides those used for electrical purposes. The quantity of this variety of graphite that was manufactured in 1904 amounted to 3,248,000 pounds, valued at $217,790, which is the largest quantity produced in any year since its first introduction on the market. This is an increase of 628,000 pounds in quantity and of $39,120 in value as compared with the 1903 production of 2,620,000 pounds, valued at $178,670. The average price per pound received for the 1904 product was 6.7 cents, a decrease of 0.12 cent as compared with the price 6.82 cents per pound received for the 1903 product. In the table following are given the quantities and values of the graphite manufactured for each year since 1897:

Production and value of artificial graphite, 1897-1904.

Year.	Quantity	Value.	Unit value per pound.
	Pounds		*Cents.*
1897	162,382	$10,149	6.25
1898	185,647	11,603	6.25
1899	405,870	32,475	8.00
1900	860,750	68,860	8.00
1901	2,500,000	119,000	4.76
1902	2,358,828	110,700	4.69
1903	2,620,000	178,670	6.82
1904	3,248,000	217,790	6.70

This table shows clearly the increase in the demand for artificial graphite, and when this table is compared with the one for domestic production it is at once recognized that the artificial graphite has assumed a very important position in the graphite industry of this country.

Qualities of the Testing Engineer.

In a presidential address before the American Society for Testing Materials, Mr. Charles B. Dudley said: "There are three kinds of testing engineers to occupy these two fields—viz.: the unattached engineer, the consumer's engineer and the producer's engineer. At first there were apparently only two kinds of testing engineers—viz.: the unattached and the consumer's. But it did not take long after consumers began to study and test materials and prepare specifications before the producers found it necessary to protect their interests and defend their materials by means of testing engineers in their own employ.

"It is perhaps hardly necessary to say that in this our analysis of the scope and field of the testing engineer we have not forgotten the various inspection bureaus and testing laboratories which are doing such excellent work in various parts of the country. As we understand the matter, these organizations, while perhaps not strictly covered by the definitions given in that they do not derive their continuous sustenance in such a way as the unattached testing engineers nor in the same way as those who defend the interests of the consumer or the producer, yet in a certain sense these independent organizations do perform exactly the same functions as the three classes of testing engineers which we have described. Any one of them will make investigations either in the interests of a client or for the sake of the truth alone; and one of them will temporarily or continuously, if the retainer be sufficient, defend and care for the interests of a consumer, or will render a like service for a producer, provided of course that the interests of the two are not antagonistic at the same time.

"What shall be the cast of mind and what the mental equipment of the testing engineer? Upon the first of these topics it is difficult to say much that is positive. It is perhaps easier to say what kind of mind will not succeed in this branch of engineering. We will perhaps all agree that he should be independent, self-reliant, gifted with the power of analysis of facts as well as with the power of drawing conclusions from the data at hand. He should be ingenious in devising methods to demonstrate the points at issue and a careful observer of data. He must keep himself free from bias or prejudice and take especial pains that he does not deceive himself. He should be fond of experiment and have a genius for it. Many times during our nearly 30 years' attempt to do something in the line of the work of a testing engineer we have had occasion to paraphrase the Latin apothegm, and say: 'Experimenters are born, not made.' He should keep constantly in mind the end to which his experiments tend and understand clearly the effect of every step in the progress of his tests and its influence on the final result. Above all, he should be a thinker. No man who when a problem is presented to him simply searches his memory for whatever he may have learned in the schools, or have perchance picked up in his reading which bears on his problem, has any especial call to be testing engineer. We are quite ready to allow that the power of seeing analogies between your own problem and one that some one else has had, and perchance successfully solved, is a legitimate and useful, not to say time saving, habit of mind. But the point we want to make is that the one who habitually and continuously approaches every problem through memory or by studying up what others have done is far less likely to succeed as a testing engineer than one who habitually attacks a problem by an analysis of its elements."

CURRENT NEWS AND NOTES.

THE CITY OF MORALIA, in the State of Michoacan, Mexico, has sold its electric light plant to a company in that city. The plant has been operated by steam. The new owners propose to utilize the San Pedrito Falls, estimated to yield at least 2,000 hp, within the next two years.

A CAT-ASTROPHE.—A San Francisco correspondent reports that a cat climbed a pole of the high-tension transmission line in Reno, Nev., and caused a short-circuit, which necessitated a 10 days' shutdown at the power house to rewind the armature. It is not stated what became of the cat.

WHAT CONSTITUTES SUCCESS.—The following appears in a Lynn, Mass., newspaper: "Marblehead appears to have been the most successful of the towns operating their own plants, for its net loss amounts to $1,500, while that of Danvers amounts to $4,000 and of Peabody to $9,000."

LIGHTNING IN GERMANY.—A cable dispatch from Dantzig, Germany, of July 3, says: "The imposing tower of St. Catherine's Church, built from 1326 to 1330, was entirely destroyed by lightning. Some of the thirty-five musical bells composing the chimes, which were cast in 1634, were melted."

HONORS FOR CURIE.—From Paris comes the following dispatch of July 8: "Prof. Curie, the celebrated discoverer of radium, was elevated this week to the dignity of Member of the Academy of Sciences, the honor following after his decoration with the Legion of Honor. The creation of a special chair at the College de France for Curie represents the last token of approval any French scientist can aspire to."

RESERVED SEATS ON TROLLEY CARS.—It is stated that the Hartford & Springfield Street Railway Company is running from Hartford a series of what it has named "reserved seat trolley trips," and in connection with these trips it has arranged to run from Springfield on special occasions for special parties, finely equipped, reserved open trolley cars with special service and on special times to any of the points of interest within trolley reach of the city.

ELECTRICITY AND RED NOSES.—A cable dispatch from Berlin of July 8 says: "Prof. Lassar, a famous Berlin skin specialist, has found means to restore red noses to their normal color and uses. An instrument, shaped like a large tooth brush, with forty platinum wires instead of bristles is used, and this is connected with an electrical machine. The treatment consists of hammering the lurid nose till it bleeds, when the treatment is stopped for a day. Two hammerings a week for some months suffice to eliminate the excessiv redness."

FRANCHISE VALUATIONS.—A large number of attorneys appeared before Supreme Court Justice Hasbrouck in Special Term at Albany, July 8, and on stipulation with Attorney-General Mayer the valuations placed on their special franchises by the State Tax Commission were equalized to the rate of valuation at which other classes of real estate are assessed in the localities in which the franchises are operated. The valuations on the New York City telephone system franchises were fixed as follows for 1904: New York Telephone Company, $4,463,530; New York & New Jersey Telephone Company, $1,481,220; Empire City Subway Company, $57,918.

TROUBLE IN THE TUBE.—A cable dispatch from London of July 1 says: "The inauguration of an electric service in the 'tube' underground railroad system resulted disastrously to-day. It had been intended to run four electric trains hourly, alternating with steam trains. For two hours all went well, but torrential rains flooded the track at one point, which prevented the electric trains going through. One electric train caught fire, throwing the passengers into a panic. The flames were quickly subdued with sand, but a live rail became displaced, bringing all the electric trains to a standstill. They had to be removed by means of steam engines." It looks as though the London tube, like the New York Subway, ought to be provided with electric launches.

MICHIGAN CENTRAL TUNNEL.—President Newman, of the Michigan Central Railroad Company, has announced that the construction of the Detroit Tunnel Line from Windsor, Ont., to West Detroit Yard, Michigan, including the electrification thereof, has been placed in charge of an advisory board of engineers consisting of William J. Wilgus, vice-president of the New York Central & Hudson River Railroad; Howard Carson, consulting engineer, and W. S. Kinnear, chief engineer of the tunnel company. The chief engineer will be in direct charge of construction, reporting to H. B. Ledyard, chairman of the board of directors, on executive and financial matters, and to the board of advisory engineers as to plans, specifications and methods of doing the work.

A WIRELESS FLOATING POOLROOM.—Hereafter "poolrooms" may be known as "lakerooms." A special dispatch from Chicago of July 3 says: "Chicago's wireless telegraph floating poolroom, the *City of Traverse,* was out of business for a short time to-day, when detectives entered the offices of the wireless telegraph company and arrested the manager and two assistants. The wireless telegraph company has been receiving racing results over the telephone from an information bureau outside the city limits. The telegraph service to the boat, according to the police, is in direct violation of the city ordinances governing gambling. The poolroom was twenty miles out on Lake Michigan when detectives made the arrests and seized all the apparatus used in the transmission of racing information. The *City of Traverse,* after a delay of an hour, connected with another station, the situation of which is unknown to the police."

TELEPHONES IN COURTS.—In a letter to the New York *Times,* Mr. J. Brownson Ker says: "My attention has been called from time to time to the inconvenience suffered by the public by reason of the custom which prevails in several of the municipal courts of this borough, of maintaining a private telephone, the number of which is not to be found in the telephone directory and cannot be ascertained from the telephone company. The absence of telephone communication necessitates persons having business with these courts sending to the court whenever they desire any information, and frequently they find that, owing to the removal of judges and stenographers from one district to another, another trip has to be taken in order to locate the official with whom communication is desired. It seems to me that as the people pay for this telephone service it should be accessible to them. There may be good reason for the present practice. If so, I should like to know upon what grounds it is upheld."

UTILIZING HEAT TO PRODUCE HEAT.—Having observed that careless locomotive firemen allow considerable energy to be needlessly wasted in the draft through the smokestack, Mr. W. H. Jordan, according to a patent issued July 4, proposes to mount a revolvable fan in proximity to said draft and to connect therewith a generator adapted to produce an electric current, and to provide an electric resistance heating device in proximity to the tubes of the locomotive boiler for the purpose of utilizing as heat the power from the said generator. The design details of the generator are omitted, but since it is suggested that the fan be mounted on a platform so as to be movable with respect to the main body of the draft, it is possible that the inventor contemplates the use of some commercial type of dynamo. Just why the engineer or fireman would take more care with the lever for moving the fan than with the lever for controlling the draft is not stated. It would be interesting to learn what induced the inventor to apply for the patent.

FORNES ON MUNICIPAL OWNERSHIP.—President Fornes, of the New York Board of Aldermen, returned from England last week. He made a careful study of conditions in Glasgow, London and Liverpool, and on landing said: "There are three great obstacles which stand in the way of municipal ownership being the success here that it is on the other side. These are the cost of material, the cost of labor and politics. While I am not opposed to government ownership, I believe the subject is one which will require the most careful consideration and study. The political system in England is different from our own. The people over there do not really elect their officers. They are mostly honorary offices, and even mayors and aldermen receive no salaries. This system must be considered, as well as what effect our own can have on the subject. We must go slow and with reflection. In proceeding, too, one must look up the tables of comparative cost. Entirely different conditions and influences hold on this side of the Atlantic, and all must be taken into consideration."

COREAN CABLE RATES.—In effect from July 1 the rate to Corea will be reduced by 25 cents per word via the Commercial-Pacific Cable; that is, Chemulpo, Fusan and Seoul will be $1.21 per word beyond San Francisco, and other places in Corea $1.29 per word beyond San Francisco.

THE TELEPHONE IN THE PHILIPPINES.—A cable dispatch from Manila, P. I., states that the Philippine Commission has passed an act granting to John I. Sabin and Louis Glass, of San Francisco, a franchise to construct telephone and telegraph systems throughout the Philippine Islands. Mr. Sabin is president and Mr. Glass vice-president of the Pacific States Telephone & Telegraph Company, representing the Bell telephone interests on the coast.

UNITED ENGINEERING BUILDING.—The United Engineering Building Committee voted a contract last week for $795,000 to the Wells Brothers Company, of New York City, for the construction of the new building under the Carnegie gift, on West Thirty-ninth Street, this city. This contract does not include anything for electrical plant, wiring, steam heating, etc., but deals solely with the construction of the edifice. The lots have already been excavated, and work will begin without delay. October, 1906, is spoken of as the time of completion and readiness.

INTERNATIONAL COMMISSION ON ELECTRICAL UNITS AND STANDARDS.—A conference has been called by the Reichsanstalt as a preliminary to the meeting of the International Commission on Electrical Units and Standards. To this conference the Reichsanstalt has invited the heads of bureaus in America, England, Belgium, Austria-Hungary, also Lord Rayleigh, Profs. Kohlrausch and Mascart, and Prof. H. S. Carhart. The conference will be held in Berlin, probably the latter part of October, the exact date not having as yet been fixed. It seems probable that the commission will be called together within the next two years.

TELEGRAPH LINES BURNED.—Reports from Dawson, Alaska, are to the effect that thousands of miles of northern telegraph lines have been made useless by sweeping forest fires throughout British Columbia, Yukon Territory and Alaska. Dawson's communication with the outside world has been broken several days, except for interrupted connection by way of Skagway and the cable. Between Dawson and Whitehorse the line fell in many places and the poles were burned. From Eagle to Valdez is another raging furnace. The line from Dawson to Fairbanks is also out of business. It is not known how much farther north the fire reaches. Nome and Fairbanks have been without telegraph service for many days.

MUNICIPAL OWNERSHIP AT GREENFIELD, IND.—A special dispatch from Greenfield, Ind., says: "Municipal ownership does not appear to be a success in Greenfield. The city owns and operates the water works and electric light plants. Over $17,000 is required for making repairs and improvements at the electric light plant. The city has no money available, and is in debt the full 2 per cent limit. An expert was employed by the council recently to investigate conditions and make a report, and he reported that a new 350-hp. engine and two new boilers were necessary, and that the cost would be $17,500. He also recommended the consolidation of the water works and the electric light plants as a saving of fuel and labor. Members of the council favor selling the electric light plant to a private company."

AMERICAN WORTHIES.—In his address last week at Asbury Park to the members of the National Educational Association, President Roosevelt said: "The roll of American worthies numbers men like Washington and Lincoln, Grant and Farragut, Hawthorne and Poe, Fulton and Morse, St. Gaudens and MacMonnies; it numbers statesmen and soldiers, men of letters, artists, sculptors, men of science, inventors, explorers, roadmakers, bridge builders, philanthropists, moral leaders in great reforms; it numbers all these and scores of others; it numbers men who have deserved well in any one of countless fields of activity; but of the rich men it numbers only those who have used their riches aright, who have treated wealth not as an end but as a means, who have shown good conduct in acquiring it and not merely lavish generosity in disposing of it." This sentiment was tremendously applauded by the audience.

WESTERN UNION AND POOLROOMS.—The wide currency given last week to a statement by the City Club of New York that agents of the Western Union Telegraph Company had recently agreed to furnish racing news to persons in this city for poolroom purposes brought emphatic denials from officials of the telegraph company. Affidavits by William J. Dealy and David B. Mitchell, who were named as having dealt with agents of the City Club, who were working to trap the company, were issued in which absolute denial was made of all the allegations. It will be remembered that this matter of supplying telegraphic news to gambling resorts was the subject of a vigorous public agitation some months ago.

DEEP SEA SIGNALS.—The Cunard Steamship Company is fitting its entire fleet with the submarine signal bells, such as have been tried successfully on the three big North German Lloyd liners, Kaiser Wilhelm II, Kronprinz Wilhelm, and Kaiser Wilhelm der Grosse. The Lucania is provided with the bells and used them with good results on the last voyage. The Caronia, Campania, and other big Cunarders are to have the new system. The sound of the bells travels through the water and is intercepted by receivers attached to the inside of the vessel near the bottom. The officer on the bridge hears the signals through a telephone and can tell exactly the direction the sound comes from and the distance his ship is from the lightship or land station. The system has been illustrated and described in our pages.

TROLLEYS IN TRINIDAD.—Mr. W. R. Holloway, United States Consul-General at Halifax, Nova Scotia, writes: "The Trinidad (West Indies) Electric Company, in which Halifax capital is so largely interested, will share in the prosperity of the colony. The company is negotiating with the government regarding the extension of its lines to St. Joseph, eight miles from Port of Spain, an extension which would pass through several large and growing villages and materially enhance the company's income from passengers and electric light traffic. The present power plant at Port of Spain is sufficiently large to supply the proposed new district. The net earnings for the first four months of this year show an increase over the corresponding period last year of nearly $5,000, and the reserve, after but two years of operation since construction was completed, amounts to more than $82,000."

MUNICIPALISM IN CHICAGO.—Mayor Edward F. Dunne has explained to the Chicago City Council his plans for municipal ownership of traction property. It was not municipal ownership absolutely, but the nearest thing possible under existing conditions. Absolute municipal ownership and operation, the mayor said, he does not consider practicable just now. The plan which the mayor offered provides for the incorporation of a company, managed by five men who command the confidence of the people of Chicago. To this company is to be granted a 20-year franchise, covering the streets in which the rights of the old companies already have expired, or soon will expire. It is to be stocked to the amount necessary to establish a street car system in these streets, roughly estimated at 240 miles. No bonds are to be sold. The stock is to be deposited with a trust company which the five directors are to select so as to prevent a purchase of it and consequent control by outside interests. The stock is to be sold at popular subscription. At any time the city may elect it can take over the property on an appraised valuation.

SUBWAY SUB-RIVER TRAINS.—The New York (Interborough) Subway has now pushed across the Harlem River and by its tunnel has access to the Bronx Borough, where the service will be highly useful to a large and growing population. The Lenox Avenue line runs to One Hundred and Forty-fifth Street. The new line to West Farms branches off at One Hundred and Forty-second Street, and a short distance farther on the trains enter the tubes under the Harlem River. These tubes are 687 ft. long, and are about 30 ft. below the water level. They are lined with concrete, and, according to General Manager Hedley, are the dryest points along the line of the Subway. The tracks are in separate tubes, each 12 ft. in diameter. There are also three pumping stations connected with the tubes to deal with leaks or overflows. The first station beyond the tunnel differs in many respects from the stations on other parts of the Subway. It is at Mott Avenue, but is about 50 ft. beneath the surface. There are two elevators with a capacity of twenty persons each as well as the regular stairway.

TELEPHONY IN CANADA.—Postmaster-General Sir William Mulock, chairman of the telephone committee of the Dominion Parliament, will visit a number of cities and towns in Great Britain where municipal telephones are in use, and will report the result of his investigations to his committee on his return. Sir William also proposes to consult with the authorities of the British Telephone Department with a view to ascertaining how the trunk line telephone system is being operated in Great Britain.

A BUST OF VAN DEPOELE.—Some time ago a bust of the well-known electrical inventor and electric railway pioneer, Charles J. Van Depoele was presented to the Lynn Public Library. Last week it was installed in a proper position by a committee of the trustees, made up of Judge R. A. Harmon and James E. Odlin, at the front of the building, near the entrance. There are several niches especially provided for the purpose, and in which other busts of national characters have reposed since the opening of the library. These are at the entrance to the library to the right of the main door as one enters. It is in one of these that the bust has been placed. Later the trustees will place a bronze tablet under it bearing an inscription descriptive of the work and life of the man. The idea of honoring other Lynn men of prominence in scientific lines is one which will be followed out in such instances as the work of the men may warrant.

VENTILATING THE SUBWAY in New York City has become a problem during the hot weather, and some small electric fans have been put in to grapple with the problem. Mr. A. A. Cary, a well-known mechanical engineer, writing to the New York *Times*, suggests this plan: "All openings not positively needed for the influx or efflux of the moving air must be closed, and doubtless other openings would have to be provided. The fresh air should be introduced at the bottom, while the foul air should be ejected from the top of the Subway, or vice versa. The inlets and outlets should be placed at positive distances in relation to each other, and the fans should be preferably of the centrifugal type and of carefully calculated capacities. The mere placing of exhaust fans at haphazard places, wherever convenient openings may present themselves, without considering the other requirements set forth above, will afford, at the best, but partial relief, and the placing of small fans (such as are found on office desks) may give some comfort to those who come within the reach of the air they set in motion. They, of course, have nothing more to do with the ventilation of the Subway than the revolving propeller of a vessel in a dirty stream has to do with the purification of the water behind it."

HIGH SPEED IN BELGIUM.—Consul-General G. W. Roosevelt, at Brussels, Belgium, writes: "The Belgium Government has sent to the Chamber of Deputies a project of law approving the convention concluded at Berlin August 15, 1903, for improved railway communication between Belgium and Germany. The agreement calls for the construction of a direct rapid line between Brussels and Aix la Chapelle. It is confidently expected that the Chamber of Deputies will pass the bill authorizing the construction of the proposed line before the close of the session, as it is a recognized fact that the present line between the two countries no longer adequately responds to the constantly increasing passenger and freight traffic. The creation of a new line is considered an almost imperative necessity, in view of the energetic competition by the Dutch lines for the transportation of passengers and freight from England to Germany and other central European countries. Immediately after the bill is passed work will be begun on the new road, the total cost of which is estimated at about 55,000,000 francs ($10,615,000). The present line running between Brussels and Aix la Chapelle will be maintained practically as it now exists as far as Louvain, from which point it will start in a straight line, passing through the towns of St. Trond, Tongres and Argenteau, to arrive direct at Aix la Chapelle. In view of the progress of the application of electricity, it is the opinion of competent engineers in this country that it will be possible in the near future to run a train of cars at the high speed of 200 kilometers (127.27 miles) per hour. The new line is to be constructed so that it may at any time be transformed into an electric road, and with this eventuality in view there will be no level crossings or ordinary bifurcations. The grades will not exceed 10 millimeters per meter (0.394 in. per 39.37 in.), and the curves not more than 8,000 meters (26,240 ft.) nor less than 2,000 meters (6,560 ft.) in radius."

Electrical Engineers of the Times.—XVIII.

J. H. HALLBERG.

Josef Henrik Hallberg was born in Falkenberg, Sweden, in the year 1874. In the spring of 1890 he graduated from Latin-Laroverket, Halmstad, Sweden. Shortly thereafter he came to America, and in October of the same year entered the Ottumwa Iron Works, Ottumwa, Iowa, as apprentice in the machinist trade. During the three years of his apprenticeship he gained much practical experience in building and testing, erecting and operating steam engines, coal mining and hoisting machinery.

After completing the apprenticeship course in 1893, he became associated with Kohler Brothers, contracting engineers in Chicago, which connection he severed in 1894 to accept a position as sales engineer with the Electric Appliance Company, Chicago, with which company he remained until 1896. For three years, or until 1899, he served as electrical engineer and designer for the Standard Thermometer & Electric Company, Peabody, Mass.

From 1899 until 1903 he was electrical engineer and designer with the General Incandescent Arc Light Company, New York. While with this company he patented and developed a complete line of modern enclosed arc lamps, alternating-current regulators, automatic transformers, switchboards and protecting devices. He has also engineered many important street lighting installations, the

J. H. HALLBERG.

most notable of which is the street lighting system in Cincinnati, O., which is remarkable in that there are installed about 6,000 4-ampere series alternating-current arc lamps which require over 105 separate circuits, with transformers, regulators and switchboards located in sub-stations. This is the largest arc-lighting installation in the world using series alternating-current arc lamps.

In 1903 Mr. Hallberg was appointed general superintendent and electrical engineer for the Cincinnati Gas & Electric Company, with full charge of its electric power stations and distribution system, comprising about 30,000 horse-power of steam and electric equipment and a large storage battery. While in charge of this plant he made many important changes in the methods of operating the power plants and the storage battery, considerably reducing losses and operating expenses. In the early part of 1904, Mr. Hallberg was elected vice-chairman of the Cincinnati Chapter of the American Institute of Electrical Engineers, in which capacity he acted during that year.

In 1904 Mr. Hallberg established an office in New York City as consulting engineer. He has been retained as consulting and advisory engineer to the Commission on Municipal Electric Lighting of New York City, and has been appointed consulting expert for the National Carbon Company, Cleveland, Ohio, in all matters relating to carbon for electrical purposes. He has also been retained as consulting engineer by several large lighting and power, industrial and manufacturing plants.

Mr. Hallberg is the author of numerous technical papers and articles. He is the inventor and patentee of electrical apparatus and systems, among which may be mentioned a single-phase to polyphase alternating-current trunk-line electric-railway system. He is an associate member of the American Institute of Electrical Engineers, an associate member of the National Electric Light Association and a member of the Swedish Engineers' Club of America.

Power House for the New York Central Electric Lines.

UTICA, 78 miles from Schenectady and 53 miles from Syracuse, has been selected as a generating and distributing point of power for the electric lines of the New York Central Railroad. The plan is to transmit water power to Utica and then to distribute it east and west along the lines of electric railway that parallel the New York Central.

In order to provide for any lack in quantity or constancy of water power, a steam turbine station of 8,000 kw capacity is being erected in Utica. At first the steam power station will carry the entire electric load, as the transmission of water power to Utica is not yet under way. The 8,000-kw steam turbine station at Utica is located on the Mohawk flats close to the point where the main line of the New York Central is joined by the Black River branch, and about 1,100 ft. from the Mohawk River. Both fuel and water are easily procured at this location, as the railway brings coal to the station conveyor, and a double line of steel pipes conducts water for boilers and condensers between the river and the steam equipment. To

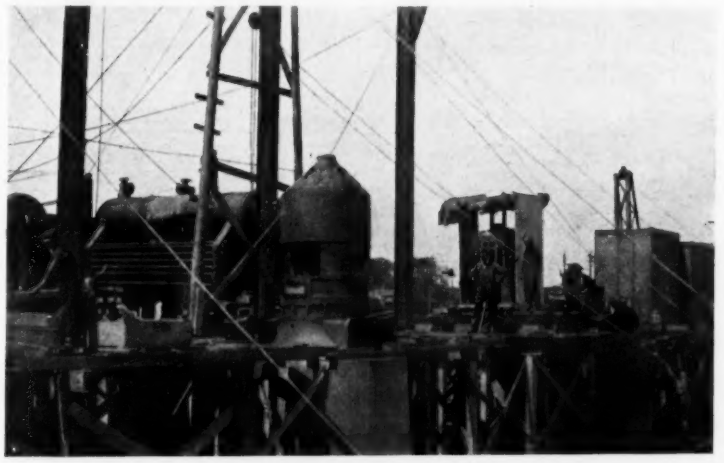

FIG. 1.—STEAM TURBINES.

make doubly sure of a supply of water for the boilers, a line of pipe has also been laid from the city supply system to the electric station.

At the location of the station the flats are marshy and only a little above the level of the Mohawk, so that it has been necessary to drive piles over the entire foundation area. Because of the expiration of a certain contract under which power has been supplied to the Utica & Mohawk Valley Railroad, it was deemed necessary to have the new turbine station in operation on July 1, 1905, and this fact has led to some exceptional methods of construction. One of these has been to build the foundations for generating equipment sooner than any other parts of the station, and then to erect the boilers and turbines before the walls were up or the roof on. (See Figs. 1 and 2.)

Above the piles the entire foundations of the station and its equipment are of cement concrete, and the upper part of the building is of steel, reinforced concrete and masonry construction. Between the center lines of its outside walls the station has a ground area of 162 by 172 ft., and besides this there is an adjoining blower house that measures 29 by 45 ft., and a building for coal machinery.

Aside from the blower and coal machinery house the station is divided into two main parts, the boiler room and the turbine room, by a steel and masonry wall that rises to the roof, as seen in Fig. 3. In elevation the boiler room is divided into basement and main floor and the turbine room has a basement, main floor and gallery floor. From basement to main floor in both the boiler and the turbine space the elevation is 9 ft., from main floor to the lower cord of roof trusses in the boiler space is 36 ft., and from main floor to lower cord of roof trusses in the turbine space is 41 ft. In the turbine space the gallery floor is 16.4 ft. above the main floor, and from the basement to the gallery floor a steel and masonry partition shuts off a space about 16 ft. wide along the outer wall of the station, and parallel with the row of turbine generators, for the bus-bar compartments, high-tension transformers and the oil switches.

In the basement portion of the space just named are the bus-bars, and at the main floor level the oil switches and the transformers. On that part of the gallery that is mostly above the oil switch room are located the low-tension transformers, rotary converters and operating switchboards. Above the gallery floor is a traveling crane that sweeps the entire space 48 ft. wide over both the turbines, transformers and rotaries. The roof over the turbine space and switchboard gallery has a monitor along the direction of its greater dimension, and there is a still larger monitor on the roof, over the boiler room.

The boiler room is designed for sixteen 500-hp horizontal water-tube boilers. The boilers are arranged in two rows with fronts facing each other along the center of the room, in the direction of its greater dimension. Over the central space between the boilers runs the coal conveyor that feeds the automatic stokers. Both rows of boilers are connected to lines of main and auxiliary headers, near the wall between the boiler and turbine rooms, and from these headers a pipe carrying a separator passes through the wall and to each turbine. Ashes from the boilers drop to pits in the basement beneath, and are thence conveyed to the railway outside. The furnaces operate with induced draft provided by steam-driven blowers, and the products of combustion pass to the outside air through short steel stacks. Water for the boilers passes through a Cochrane heater of 6,000 hp rating, and as surface condensers are employed to handle the exhaust steam, the boiler water is used over and over. A part of the horizontal water-tube boilers are the product of the Franklin Works at Troy.

In the turbine room foundations are provided for five vertical generators that are to be made by the General Electric Company. Two of these turbines will be of 1,000 kw and three of 2,000 kw each, thus giving the total capacity of 8,000 kw. Each of the 1,000-kw units is connected to a surface condenser of 3,500 sq. ft., and each of the 2,000-kw units to a condenser of 6,850 sq. ft., both of the Worthington make.

With these units there are the necessary vacuum and hot well pumps. From each condenser there passes one pipe to the intake main and one to the discharge main, that carry water between the generating station and the Mohawk River, 1,100 ft. distant. Each of these main pipes is of steel and is 36 in. in diameter. The discharge pipe vents directly into the river, but the intake pipe ter-

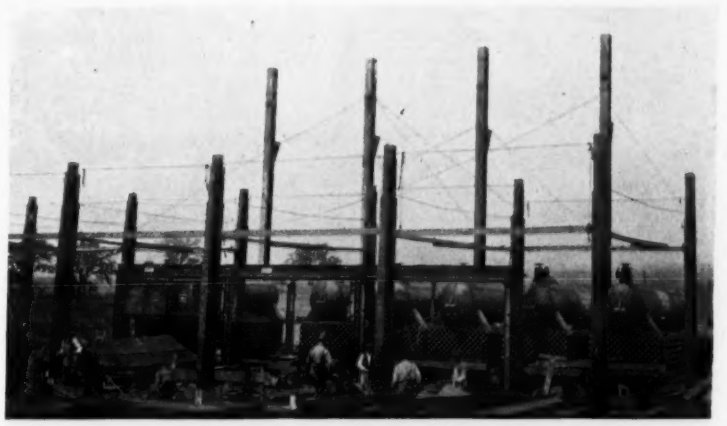

FIG. 2.—BOILER HOUSE IN PROCESS OF ERECTION.

minates in a pump house on the river bank. This house, a view of which is given in Fig. 4, measures 23 ft. 10 in. by 38 ft. 10 in. in plan outside, is one story in height above the water chamber, and is constructed of concrete, steel and expanded metal.

On the river front of the pump house there is a steel intake frame with screen through which the water flows into the chamber beneath the house. The circulating pumps must lift the condensing water about 15.5 ft. above the low river level, besides overcoming the friction of the pipes. For this work three centrifugal pumps direct-connected to as many induction motors are located in the pump house, and lift the water from the river level and force it into the 36-in. intake main. Each of these motors is rated at 100 hp with 2,300-volt, 40 cycle, three-phase current, and operates with its connected pump at 600 r.p.m. Besides its connection to a condenser, each steam turbine has another pipe that joins a 30-in. free air exhaust that rises above the roof of the station.

Each of the above-named turbine generators develops three-phase current at 40 cycles per second and 2,300 volts. This current all goes to transformers by the way of oil switches, save that consumed

in the 2,300-volt induction motors at the generating station and the pump house. Exciting current for the turbine generators is to be supplied by two dynamos, each of which is direct-connected to a 2,300-volt, 40-cycle, three-phase induction motor.

a transformer of 1,333 kw capacity. A pair of rails is laid in front of these transformer cells, which are in a single row, and by means of a truck any transformer can be moved into or out of its cell.

On the gallery floor above these high-voltage transformers there

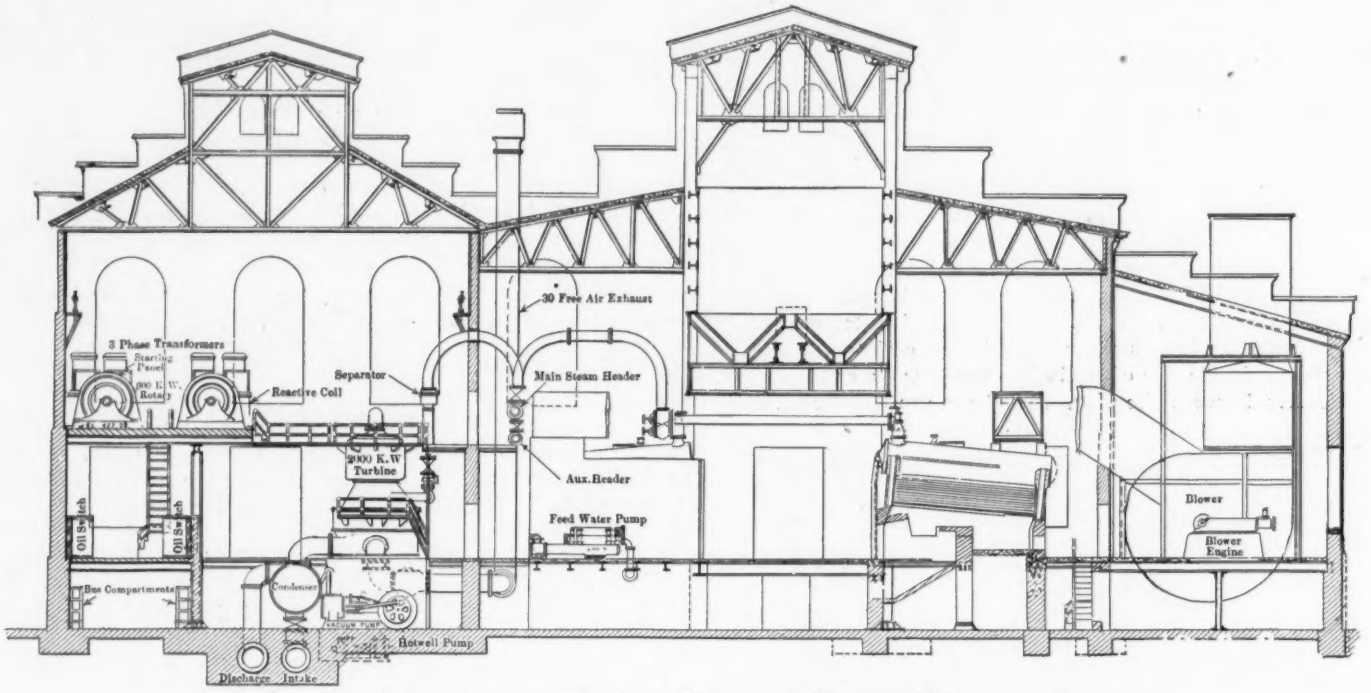

FIG. 3.—SECTION THROUGH BOILER AND TURBINE ROOMS.

On the gallery floor at one side of the turbine room space is provided for the motor-driven exciters, for transformers and for rotary converters and reactive coils, besides the switchboard and bench-

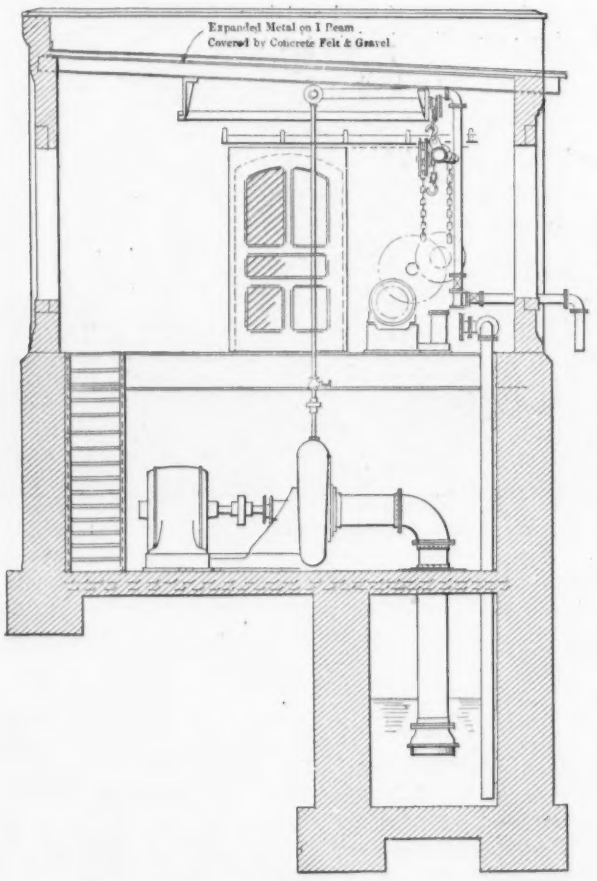

FIG. 4.—VERTICAL SECTION THROUGH PUMP HOUSE.

board. Beneath this gallery is the oil switch room and the space for the high-voltage transformers.

The transformers will be located in fifteen concrete cells, each of which has a floor area of 8.66 by 13 ft., and is designed to contain

will eventually be located six 600-kw rotary converters at 600 volts direct current. Each of these rotaries will be provided with a reactive coil of 90 kv-amp. rating, and will receive 40-cycle, three-phase current from a 600-kw, three-phase transformer. These transformers for the rotary converters will take current either from the 2,300-volt turbine generators or from the high-voltage transformers in the room beneath the gallery when these latter receive the transmitted water power.

Each of the 1,333-kw transformers will be single-phase, and they will, therefore, be connected in five groups of three each to handle the three-phase current from either the turbine generators or from water power plants. These five transformer groups will have a combined rating of 20,000 kw. Each transformer has one set of windings for 2,300 and the other set for 17,100 volts. The 17,100-volt winding is in two parts and when these parts are connected in series the winding either takes or delivers current at 34,200 volts. When the 2,300-volt winding is used as the primary, taps in that winding make it possible to develop either 20,000 or 30,000 volts in the secondary coils, according as they are connected in multiple or in series.

From the characteristics of each transformer, it may be seen that when three have their high-pressure coils connected in delta these coils may either receive or deliver three-phase current of 17,100, 20,000, 30,000 or 34,200 volts. With the high-pressure coils of three transformers connected in star form, three-phase current at as high as 60,000 volts may be received or delivered. The utility of this variety of possible voltages may be seen from the fact that three-

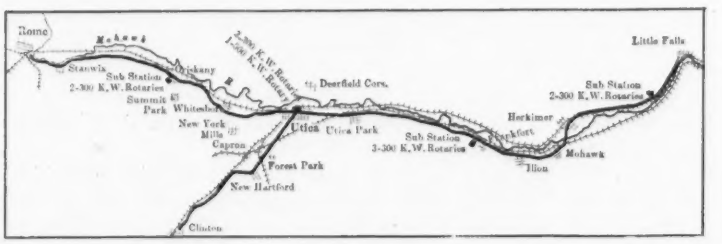

FIG. 5.—MAP OF THE UTICA & MOHAWK VALLEY RAILWAY.

phase, 40-cycle current is to be transmitted from the turbine station at all of them from 17,100 volts up, and that current of the same sort is to be received at this station from water power plants. Under these conditions the fifteen 1,333-kw transformers will be used to

step up or step down current, according as it is generated by steam or water power.

The first work to be done by the new turbine station is to supply current for the operation of the Utica & Mohawk Valley Railway, whose main line is parallel with the New York Central for a distance of 35 miles between Little Falls and Rome, passing through Utica on the way, as shown in Fig. 5. In 1904 this electric railway system comprised 95 and operated 110 miles of road, and it now forms a part of the New York Central electric system.

The Utica & Mohawk Valley road operates four sub-stations, one near Little Falls, one at Frankfort, one at Utica, and one at Oriskany. After July, 1905, the Utica sub-station will be at the new generating station above described, and will, for the present, contain one 500-kw and three 300-kw rotary converters.

At each of the other three sub-stations named above there are two 300-kw rotary converters, and each pair of these rotaries is fed with current from 200-kw transformers. These transformers are wound for either 17,100, 20,000, 30,000 or 34,200 in their high pressure coils, like the 1,333 units that are to be installed at the generating station. It is expected that at present they will receive current at 20,000 volts.

It was April 16, 1905, when the flats where the new plant is located were dry enough so that work could begin, and the station is at present ready for operation.

So great has been the haste on this station that the General Electric Company, which is supplying the electric equipment, has been unable to deliver the 1,000 and 2,000-kw turbines when they were wanted, and has loaned some 500-kw turbine units until the larger machines can be completed.

Mr. C. E. Parsons, Chief Engineer of the Hudson River Electric Power Company, has supplied the facts as to this interesting plant.

The New York and Massachusetts Commissions of Gas and Electricity.

BY ALTON D. ADAMS, LL.B.

MASSACHUSETTS established a gas commission by an act of its Legislature, in 1885, and New York, after twenty years, has just followed the unique example of the Bay State. Two years after its creation the authority of the Massachusetts commission was extended to the new industry of electric lighting, and later statutes, from time to time, have greatly increased its powers over these two lines of public service. In a large degree the New York commission of gas and electricity just created, has been clothed with the same important powers that have been delegated to the Massachusetts commission. Though it cannot be fairly said that the New York act is a copy of the Massachusetts statutes on the same subject, it seems plain that the legislators of the former state have profited by the experience of the latter.

In New York, as in Massachusetts, the commission consists of three members appointed by the governor, one of whom is designated as chairman. No person is eligible for appointment in New York who holds any official relation to a gas or electric corporation, or who owns any stock or bonds therein. To these requirements the Massachusetts law adds that no commissioner shall engage in any business save that of his office. Besides its principal office in Albany, the commission may have one branch office in New York City, and one in Buffalo. In the Bay State, the only office of the commission is at Boston, but, as in New York, meetings of the commission may be held in any part of the state. The governor of Massachusetts appoints the clerk of the commission there, but the Empire State commission selects its own clerk, as well as its other assistants, subject to civil service law. In the matter of salaries, New York is more generous than her sister state, and pays to each commissioner eight thousand dollars yearly; while the chairman receives four thousand dollars, and each of the other commissioners three thousand five hundred dollars, in Massachusetts.

The commission in each of these states has general supervision of all persons and corporations engaged in the distribution of gas or electric energy by way of the streets or highways. In each state the power of the commission extends over both the physical and financial operations of corporations engaged in gas or electric supply. By the definitions of the New York statute, the term corporation covers a company, association and joint-stock association, but does not include a municipality. The New York commission may regulate the physical operations of the gas and electric systems operated by a city, village, town or lighting district, and may inspect the books relating to these systems, but cannot control the financial doings of a municipality in relation to its gas or electric business. In this respect the Massachusetts commission has greater powers, for it can fix, under certain conditions, the rates at which a city or town shall furnish gas or electric service to private consumers.

A corporation, "incorporated" after the New York statute went into effect, cannot engage in gas or electric supply until it has obtained a certificate of authority from the commission, and if in the opinion of the commission the territory where the corporation proposes to operate is already well supplied with the kind of service that the corporation proposes to render, then the commission may refuse to grant the certificate. It is to be noted that this provision applies only to corporations "incorporated" after the act creating the commission went into effect; and as voluntary associations and partnerships are not "incorporated," it seems probable that the provision does not apply to them. Certainly the provision does not apply to a single, natural person who proposes to erect a gas or electric system. The provision in question evidently does not apply to corporations that were chartered before the act creating the commission was passed, and it is understood that a large number of corporations were formed to do gas and electric business pending the enactment of the statute. Even if the New York commission desires to prevent competition in the gas and electric business, it is evident that it has not the power. In this respect the authority of the Massachusetts commission is much greater, for it may refuse to allow either a single, natural person, a partnership, or any corporation to invade the territory occupied by a gas or electric company with another similar system. No municipality in New York can erect and operate a gas or electric system for other than municipal purposes without authority from the commission. In Massachusetts, this matter is not subject to the commission in any way, but it is provided by statute that a city or town cannot erect a gas or electric system, even for the sole purpose of lighting its own streets, without first buying the local system of the sort that it proposes to erect, if the owners of the local system elect to sell. A gas or electric corporation "incorporated" after the act creating the New York commission went into effect cannot issue either stock or bonds until it has obtained the above named certificate of authority from the commission, and until the commission shall certify as to the amount of stock or bonds reasonably necessary for the purposes of the corporation. The issue of stock or bonds by the new corporation shall not be greater than the amount as certified. No corporation subject to the commission, whenever incorporated, can increase its issue of stock or bonds without the written consent of the commission, stating the amount of the increase, but the statute does not say that this increase shall be limited in any way. To reach its decision as to the amount of issue or increase of stock or bonds, the commission may take testimony, examine the books and papers of the corporation, and require verified statements from its officers. In Massachusetts the amount of stock or bonds that any corporation engaged in gas or electric supply may issue is limited to what the commission finds to be reasonably necessary for the purposes for which the issue is authorized by it. Before this commission authorizes an increase in the stock or bonds of a corporation, it may require that the structural value of the plant of the corporation be brought up to the amount of the capital stock and debt.

A gas or electric corporation in New York cannot transfer or lease any part of its franchise or property, or contract for the operation of its system, without the consent of the commission. Neither can such a corporation, directly or indirectly, acquire the stock or bonds of another corporation engaged in or proposing to engage in the same or a similar business, unless authorized by the commission to do so. This provision of the statute does not seem to reach the case of a holding corporation which may be formed for the sole purpose of acquiring the stocks and bonds of gas and electric companies. Whether a gas or electric corporation in New York can mortgage its property or franchise without the consent of the commission, under the provision just cited, is an interesting question, but the probability is that it cannot.

In Massachusetts, a gas or electric corporation may freely mortgage its property and franchise to secure its bonds, but these bonds

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can be issued only by the authority of the commission. This commission may authorize the purchase of the property and franchise of an electric company by a gas company, but it does not appear to have authority to sanction the consolidation of two gas companies or two electric companies. It is interesting to note, however, that these companies have found a way to consolidate, in Massachusetts, without the consent of either the legislature or the commission. As to the purchase of the stock or bonds of one gas or electric company by another, in the state just named, it seems that the commission has no direct authority, but it may refuse its consent to an issue of stock or bonds for such a purpose.

If the New York commission refuses any certificate, authority or consent as to the transaction of gas or electric business, the issue of stock or bonds, or the transfer of franchise or property, which it has power to grant, an appeal lies to the appellate division of the supreme court of the third department, and this court may order the commission to grant the certificate, consent or authority desired. No such appeal as this can be had in Massachusetts, and the decision of the commission there on matters that lie within its discretion is final, except in cases where a special act of the legislature allows an appeal as to a particular company. Of course, the Massachusetts and the Federal courts are open to a suit based on a claim that some action of the commission there is illegal.

One of the most important powers delegated alike to the New York and the Massachusetts commisson is that of fixing maximum rates for electric and gas service. Neither commission can fix rates on its own motion, but can act in the matter only after a complaint to it has been made. In New York, a complaint as to either the quality or rates for gas or electric service may be lodged with the commission by either the mayor of a city, the trustees of a village or the board of a town, in which a person or corporation is authorized to supply gas or electricity. One hundred consumers of gas or electricity may likewise bring a complaint before the commission as to quality or prices. After an investigation of the plant and books of the gas or electric system, and after a public hearing before it, at which all interested parties may be represented, the commission may order an improvement in the service, or may fix the maximum price to be charged for gas or electricity. The price so fixed is the maximum price that may be charged for gas or electricity by the person or corporation affected in that place for a period of three years and until, after the expiration of this period, the commission shall again upon complaint reconsider the evidence and fix the price of gas or electricity.

Any person or corporation aggrieved by an order made by the commission upon complaint or otherwise may apply to the appellate division of the supreme court. "Such court may affirm, reverse in whole or in part or modify the order appealed from, or may make such order in the premises in its discretion as it may deem just and proper." This provision of the act raises a question under both the New York and the Federal constitution, and its validity will no doubt be tested in the courts. It is generally held by the courts that the fixing of rates for public service is a legislative and not a judicial function, and that it cannot be delegated to the courts. A court can probably review a rate that has been fixed by a commission, and if the rate is found to be reasonable affirm it, though even this power is question by some lawyers. But when a court modifies a rate fixed by a commission, and makes such order in the premises as it may deem just and proper, the court is evidently fixing rates, pure and simple. Will the New York courts support this fixing of rates as a judicial function? If supported by the New York courts, will this judicial rate-making pass muster with the Federal courts as due process of law?

The New York statute makes no provision for a petition by a gas or electric company for an increase in rates previously fixed by the commission. In Massachusetts, the mayor of a city, the selectmen of a town or any twenty consumers may bring a petition before the commission asking for a revision of rates or for improved service. The owner of a gas or electric system may also petition the commission to reconsider a rate that has previously been fixed by it. Under the New York statute no action can be brought before the commission there to fix the rate for gas or electric supply from a plant operated by a town, city or village, but this can be done by consumers served by a municipal gas or electric plant in Massachusetts. In that state also no municipal plant may furnish gas or electricity to private consumers at rates that do not yield a certain profit, save with the consent of the commission. From the rates fixed by the Massachusetts commission there is no appeal, except that the constitutional and Federal question as to the reasonableness of these rates can always be raised, just as it can in New York. The constitutional test of reasonable rates, as applied by the Federal courts is, in general, that they shall yield a fair return on the value of the property devoted to the public service. During the twenty years since the creation of the Massachusetts commission, in which it has fixed scores of gas and electric rates, it seems that the question of their constitutionality has been raised before the courts in only a single instance. Orders of the Massachusetts commission as to rates or other matters relative to gas and electric plants are enforced by suits in equity brought by the attorney general on behalf of the commission. In New York, either the commission or any person, corporation or municipality interested in the enforcement of its orders, may apply to the supreme court for a writ of mandamus to compel compliance therewith. The statute also provides that if any charge for gas or electricity is greater than that fixed by a statute or by the commission, this fact shall be a complete defence to any action that may be brought to recover payment for the gas or electric service.

A duty imposed on the New York commission is to investigate the methods employed by persons, corporations and municipalities in the supply of gas and electricity, and to order such improvements as will best promote the public interests. The illuminating power of gas, and the pressure at which it is delivered, are to be fixed by the commission, and the same body may prescribe the methods of bookkeeping to be followed by persons, corporations or municipalities engaged in the manufacture and distribution of gas or electricity. Books and papers pertaining to affairs under investigation may be ordered before the commission which may also subpœna witnesses, administer oaths and take testimony in proceedings by or before it under the act.

A systematic method for the inspection of gas meters, may be provided for and regulated by the commission. Each corporation under the supervision of the commission is required to make an annual report to it, verified by oath, showing in detail the amount of its stock, bonds, income, expenses, dividends, salaries and wages, also giving the location of its plant, a description of its property and franchises and such other facts pertaining to its affairs as the commission may demand. These reports must be in the form and submitted at the time prescribed by the commission. On its part the commission must make an annual report to the legislature of its investigations and proceedings. This report must also contain an abstract of the reports of gas and electric corporations, explanations of the methods employed in the manufacture and sale of gas and electricity, and suggestions for the better protection of the public interest as to the operations of these corporations.

Powers vested in the New York commission as to the investigation and regulation of the gas and electric business, as just outlined, appear to be somewhat more extensive than the corresponding powers of the commission in Massachusetts, as to corporations. In this latter state, however, the power of the commission to investigate and to require reports, extends to all persons and municipalities engaged in gas and electric supply, as well as to corporations. Though the Massachusetts commission has power to inspect the books and papers relating to gas and electric systems, there seems to be much doubt as to its authority to require the production of such books and papers before it, and the commission does not, in fact, subpœna witnesses or put them on oath.

In its supervision of gas and electric systems, the Massachusetts commission does not attempt to regulate their physical operations beyond the requirements of proper service to consumers, save as to matters expressly fixed by statute. The New York statute provides simply for the payment of the salaries and expenses of the commission from the state treasury, but in Massachusetts all of these amounts are subsequently assessed upon the gas and electric systems.

For twenty years the Massachusetts commission has been making decisions on questions of capitalization, reasonable rates, and many other matters such as must now come before the commission in New York. These questions as they come up involve considerations of both law and of sound public policy. While these decisions can have no binding force in New York, it seems not improbable that they may be allowed some persuasive weight with the commission there.

The Variation of Electrical Resistance in the Contact of Carbon and Cast Iron.

BY ERIC SCHOENAU.

A LARGE number of induction motors are built in which the rotor is connected to the starting resistance through carbon brushes resting on cast-iron collector rings. In testing a motor of this character in the laboratory of the University of Kansas

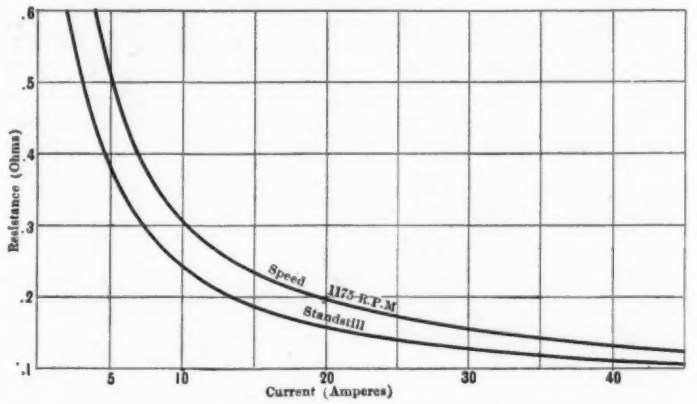

FIG. 1.—CURVES OF SECONDARY RESISTANCE.

it was found impossible to get satisfactory results by the usual core loss and impedance method, owing to the magnitude and variable nature of the contact resistance of the brushes. This experience led the writer to choose as the subject of his graduating thesis a more extended investigation of the variations of the resistance of such contacts. The results of this investigation appeared to be of sufficient interest to warrant publication, and they are presented herewith.

Fig. 1 shows the secondary resistance of a 7½-hp General Electric three-phase motor, plotted as a function of the current. The extreme variation of this resistance with the current is remarkable, as is the magnitude of the brush and contact resistance, the resistance of the rotor alone being 0.0387 ohms. Evidently the assumption of

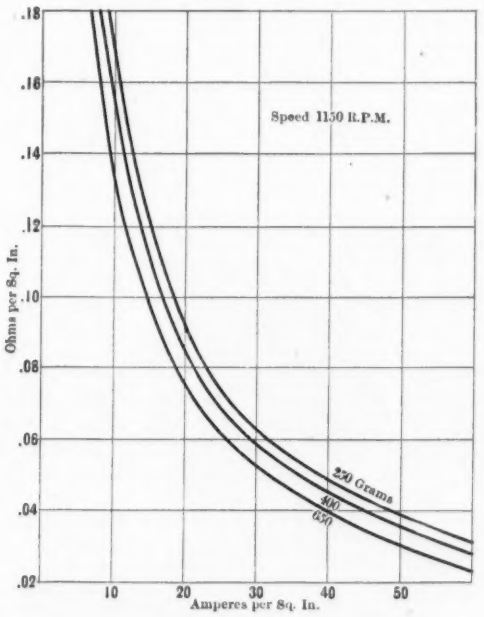

FIG. 2.—VARIATION OF RESISTANCE.

a constant secondary resistance in working up core loss and impedance readings on this motor would lead to serious error, and the use of contacts of this nature in the secondary circuit very materially effects the performance of the motor, particularly the slip and efficiency.

Further experiments were carried out with a cast-iron wheel placed on the shaft of a small direct-current motor and rotating in contact with carbon brushes in the familiar old style brush holders. The front faces of the brushes had an area of 0.469 sq. in. and the resistance was measured by means of a Weston ammeter and a low-reading Weston voltmeter, both having been carefully calibrated.

The curves of Fig. 2 show the variations of resistance with current density. At low values of current density the resistance is low, but by increasing the density the curves show a falling off

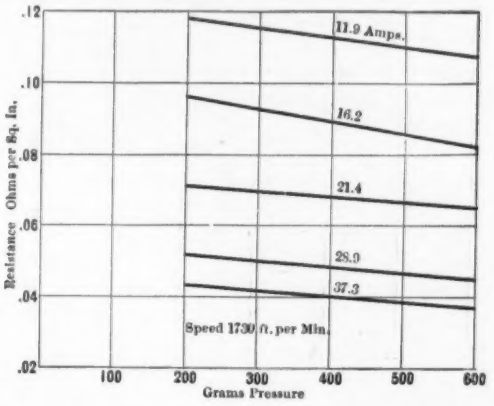

FIG. 3.—RELATION OF RESISTANCE AND BRUSH PRESSURE.

along a curve to a hyperbola, which is to say that the voltage drop across the gap is almost independent of the current.

A fact to be considered in all the observations is that graphitic carbon has a negative temperature coefficient of resistance and

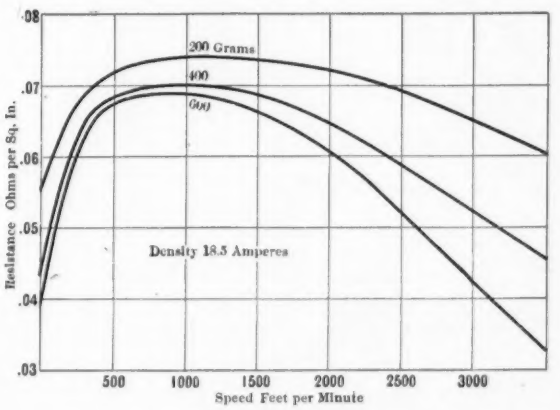

FIG. 4.—RELATION OF RESISTANCE AND SPEED.

hence, on heating, the resistance is lowered. However, the film of carbon through which the current had to pass was so small that any such change would necessarily have to be very small.

The curves of Fig. 3 show the relation between resistance and

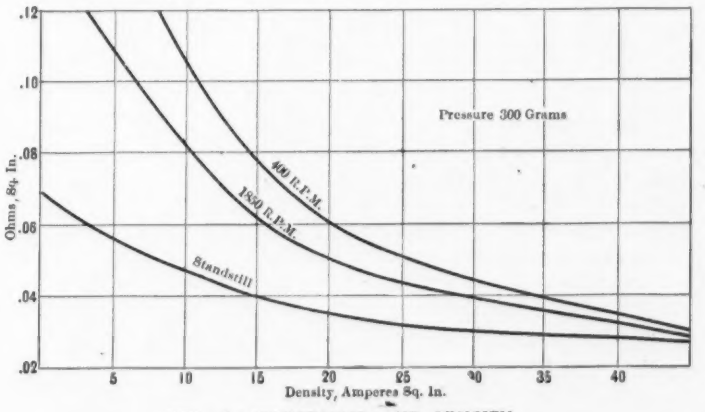

FIG. 5.—RESISTANCE AND DENSITY.

brush pressure when the disc was revolving at a speed of 1,730 ft. per minute. The resistance is lower, of course, at higher than it is at lower pressures, while with lower densities there is a more rapid falling off of resistance than there is with high densities.

Fig. 4 shows the relation between resistance and speed in feet per minute. The density was held constant at 18.5 amperes and data were taken at various brush pressures. The resistance rises from standstill up to about 800 ft. per minute, and then falls off. At higher pressures the more rapid decrease in resistance is probably due to heating.

The curves of Fig. 5 show the resistance as a function of the

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density. After 45 amp. per sq. in. has been reached, the resistance has practically attained a constant value regardless of speed. At

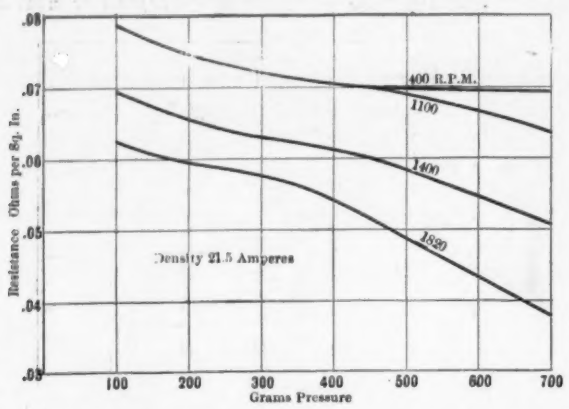


FIG. 6.—RELATION BETWEEN RESISTANCE AND BRUSH PRESSURE.

400 r.p.m. we find a greater resistance than either at standstill or at 1,850 r.p.m. This may also be noticed by reference to Fig. 6.

Fig. 6 shows the relation between resistance and brush pressure.

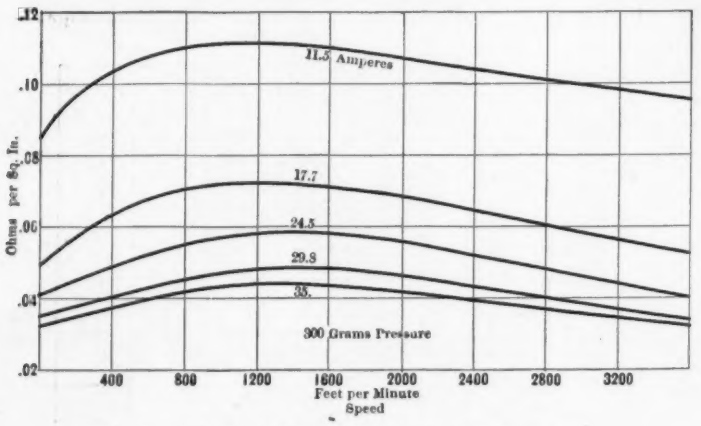


FIG. 7.—RELATION BETWEEN RESISTANCE AND SPEED.

The contact resistance between speeds of 410 r.p.m. and 1,100 r.p.m. is about the same until a pressure of 450 grams is reached.

The curves of Fig. 7 show the relation between resistance and speed. The pressure maintained on the brush was 22.8 ounces per sq. in., which is an ordinary value in practical work.

The Murgas System of Wireless Telegraphy.

The Murgas wireless system which has been successfully tried in the vicinity of Wilkesbarre, has been confined entirely to land operations. Many of the mountain ranges rise up 1,500 ft. higher than the hill on which the Wilkesbarre station stands, and between Wilkesbarre and Scranton, where the second station has been erected, there are several peaks of this height in the range which runs at an angle across the path of the waves, but so far the contour of the land seems to have had little effect in preventing the proper transmission of signals.

The only troublesome element is the presence of inductive disturbances. The line, as it may be called for convenience sake, is situated in a particularly awkward position as regards electric railways. There are three short roads which lie about one-quarter of the distance, two lie at least half, and one, the famous "cannon ball," of the "Laurel line," and a third-rail system, not only parallels the whole from station to station, but at the Scranton end makes an entire circle around the building. Measurements taken with a ballistic galvanometer on the antennæ at all hours at Wilkesbarre show the inductive disturbance to be very great, at times the spot of light from the mirror of the galvanometer traveling by a series of jerks entirely off the scale. On other occasions when the antenna was brought into proximity to the earth there could be obtained in the air-gap sparks ¼ to ½ in. in length, and at very regular intervals, the period averaging from above five to one per second.

Such a problem as this was no easy one to solve, and Rev. Father Murgas, the inventor of the system, when he found this state of affairs to exist, after having gone to the expense of building both stations and thoroughly equipping them, taking years of planning and months to erect, learned that his work was by no means near completion. After several weeks of careful and minute investigation he at last hit upon the proper syntonization, and messages passed freely back and forth with no disturbance from external influences whatever. In arriving at this point of perfection, Father

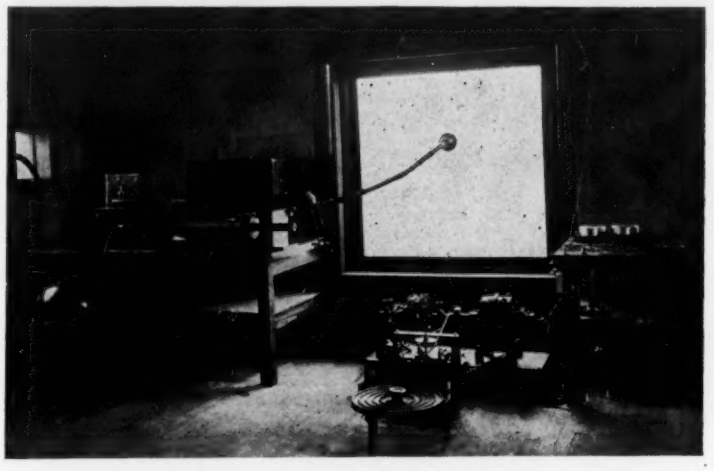


FIG. 1.—TRANSMITTING APPARATUS.

Murgas found it necessary to reconstruct the transformers, readjust the condensers and choke coils several times. Calculation could not often be depended upon, so that it was a matter of continuous experimentation to arrive at the proper tuning.

The fundamental features of the system involve the use of separate tones or tone impulses by the use of two interrupters working on the same induction coil. Such impulses being received in an ordinary telephone receiver by means of proper apparatus, tones differing in pitch will be produced, and while the number of tones which may be produced is indefinite and a variety of codes may be used, two tones are sufficient to produce a system analogous to the Morse, one tone corresponding to the dot and the other to the dash. For reasons as already stated the rapidity of transmission will be greatly increased by such a system, and, moreover, signals differing in character are more readily distinguished from each other than those which depend upon time intervals for differentiation. Tones are

FIG. 2.—RECEIVING APPARATUS.

well distinguished in physics from other sounds, and the range of frequencies of vibration within which tones are produced is sharply defined. They are more readily distinguished than other sounds, and hence in systems employing a telephone receiver it is preferable to make the frequencies of the impulses come within the range to produce a tone. The interrupters above mentioned are running constantly and are connected through a double key similar to that used in the syphon recorder system, except that the keys are quite distinct from each other, and each operates one interrupter. The signals will, therefore, be transmitted to some extent as in long-distance cable telegraphy, but will be received by telephone or by an apparatus similar to the old needle with the differently toned bells, used by the British Post Office some twenty-five years ago.

The power for transmission is supplied at twenty-four volts and three amperes on the primary circuit, and the spark from the great induction coil on open circuit is about six inches when operating to Scranton. With this small current the common telegraph key is found to be large enough. A view of the transmitting apparatus is given in Fig. 1.

The coherer used with the telephone is of the imperfect contact type. It consists of a needle, making about one revolution in two hours, on which rests on their edges several small carbon pieces cut from a thin disc or diaphragm like those used in a telephone transmitter. It is perfectly self-restoring and increases the tones about ten times. Fig. 2 shows the receiving apparatus.

The towers are 150 ft. high, with an additional mast arm, making a total height of 200 ft. They are substantially built of good pine, with elbow and connecting plates of iron, as may be seen from the illustration, and there are no guy wires except those used between the top of the towers and the top of the mast arms, and these are of galvanized iron broken in several places by strain insulators. (See Fig. 3.)

The antenna is composed of 10 cables made of No. 10 B. & S.

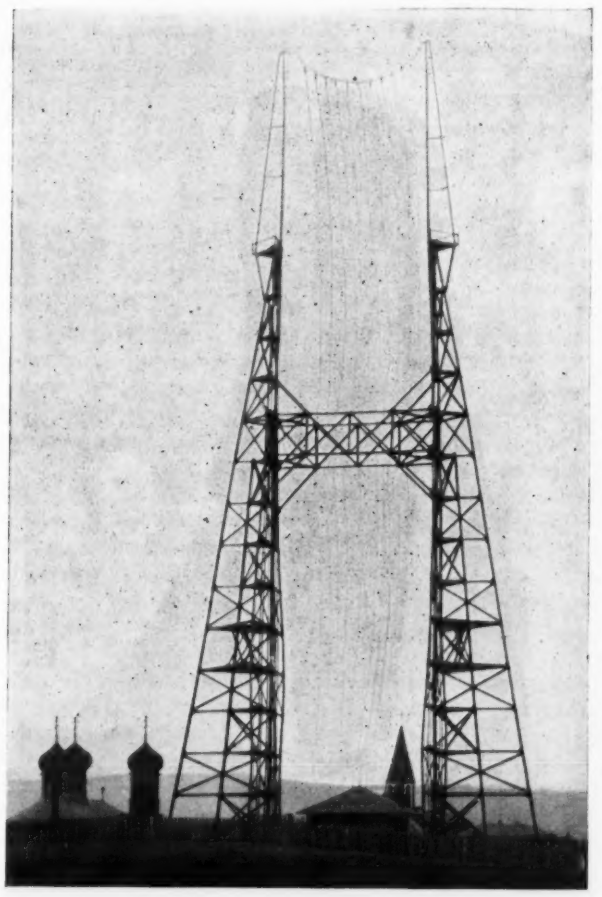


FIG. 3.—TOWERS AT WILKESBARRE.

stranded, well-insulated copper wires. Each cable hangs from a separate insulator of particularly well-insulated construction. Each insulator is a rubber rod 30 in. long and 1.5 in. thick, with outer petticoat tubes of polished hard rubber. The insulation of the antenna cables is practically perfect, hanging as they do from a cross rope connected to the top of the mast arms. At a height of 30 ft. from the ground all of the cables are fastened to another cross rope attached at each end to a 150,000-volt insulator, and from that point they are gathered in a bunch and brought into the operating room through a hole in the center of a square plate glass window.

The earth connection, which measures 4 ft. on each side, goes through a smaller window, and is made of a flat strip of copper attached to the water pipes of the regular city water supply.

The tuning device is similar to the Slaby-Arco system, but with a peculiar arrangement of the auto-transformer by which the tuning can be adjusted very readily.

Signals have been transmitted recently with great regularity and outside interference seems to have been entirely overcome. The earlier experiments, up to the point where something really definite was arrived at were carried on entirely at the inventor's own expense. This covered a period of several years and was a heavy drain on his own private resources. Fortunately, at this point he was able to obtain the aid of the Electric Signal Company, of Philadelphia, and through the president, Mr. Joseph F. Stokes, he has been placed in a position to carry out all experiments on any scale desirable. The Wilkesbarre station is built of concrete and is very roomy and comfortable, with quarters for an operating staff. The station at Scranton is also completed.

Works of the Electrolytic Alkali Co. at Middlewich, Cheshire, England.

BY JOHN B. C. KERSHAW.

THE works of the Electrolytic Alkali Company at Middlewich, Cheshire, were erected in the years 1900-1901, and the first unit of plant was put in operation in April of the latter year. Middlewich was chosen as the site for these works on account of its being situated above the Cheshire salt deposits. Brine is pumped directly from the company's own brine wells into the decomposing cells, without the necessity for, or expense of, any intermediate separation in the solid form, and re-solution in water.

The works cover a very large area of ground and are well placed

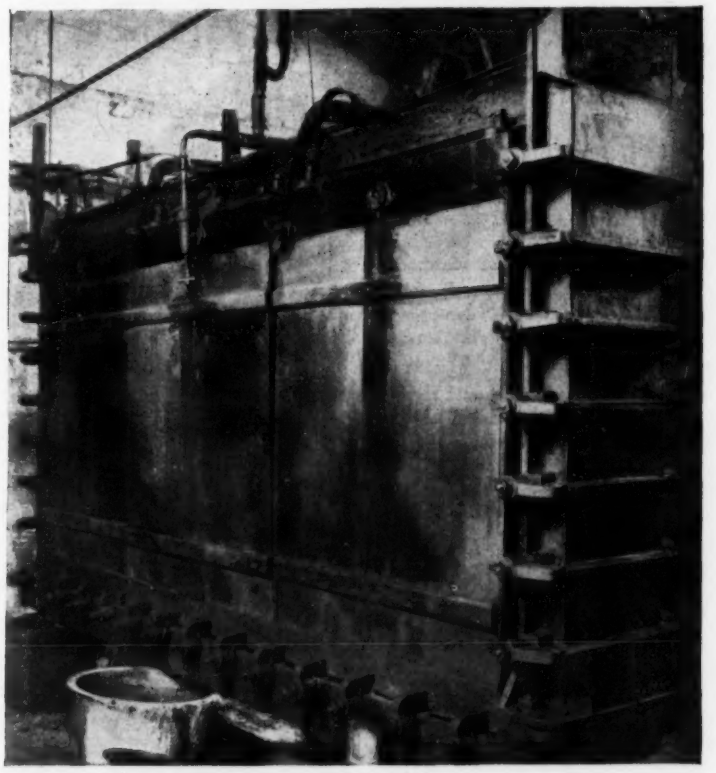


FIG. 1.—VIEW OF CELL UNDER WORKING CONDITIONS.

as regards railway and canal services. The boilers are of the Lancashire type, partly hand-fired and partly provided with mechanical stokers of the underfeed type. The generating machinery comprises six sets of horizontal cross-compound Roby engines, each rope-geared to two continuous-current generators, producing current at 60 volts. The normal output of each dynamo is 2,000 amp., and the total capacity of the generating plant is, therefore, 1,440 kw.

The cell room is a very spacious building containing 250 cells of the Hargreaves-Bird type, two-thirds of which are kept in constant operation. Fig. 1 is a photograph of the Hargreaves-Bird cell in working condition, and Fig. 2 shows a sectional elevation of the cell. The cell is 10 ft. in length, 5 ft. in depth and 14 in. in breadth, the narrow chamber enclosed between the two diaphragms being filled with brine and provided with a row of anodes as shown in Fig. 1. The two outer compartments of the cell on each side are the cathode chambers. These are supplied with steam and CO_2 gas, and the sodium carbonate which separates on the gauze cathodes is at once washed away as a solution of sodium carbonate by the condensing steam.

It was originally intended to employ gas engines for generating the electric current, and to employ the exhaust gases from these in the cathode chambers of the cells, in place of steam and CO_2; but it was found that solid carbon from the hydrocarbon gases remained in suspension in the exhaust gases and that this carbon entered and discolored the final product—the soda crystals. It has, therefore, been necessary to erect a lime-burning plant at Middlewich for supplying the necessary CO_2 gas to the cells, and the steam is obtained from the boiler plant.

Some portion of the caustic lime produced in the lime-burning plant at Middlewich is employed in the bleach chambers, and the remainder is sold. The carbonated soda liquors from the cells are passed through a refrigerating plant in order to obtain the maximum yield of crystal soda, and the mother liquors are finally thrown away. The decomposing cells are worked in series of 14, two of these being held in reserve for cleaning and repairs. A current of 2,000 amp. is the normal one for these cells, the row of 12 thus taking the electrical output of one dynamo. The e.m.f. required per cell varies from 4 to 4.5 volts; and each decomposes about 220 pounds of salt per 24 hours.

The anodes and cathodes employed in these cells are of special construction, and a large number of men are employed in the works in manufacturing them. The cathodes are of strong iron-wire gauze, covered on one side with the special silicated asbestos composition, which forms the diaphragm. Each cathode is 10¼ ft. by 5¼ ft. in superficial area, and each cell possesses two of these composite diaphragm cathodes, one placed on each side of the inner anode chamber and forming its sidewall.

The anodes are made up of rows of rough blocks of gas carbon, strung upon a central support of lead-copper alloy. Cement is used

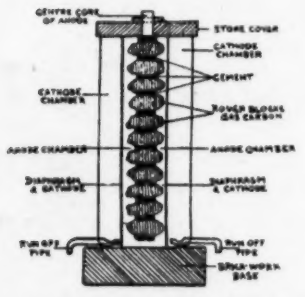


FIG. 2.—SECTION OF HARGREAVES-BIRD CELL.

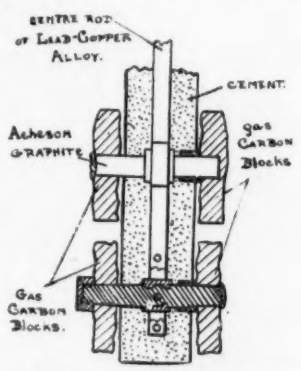


FIG. 3.—SECTION OF ANODES.

to cover the latter, where it is not covered by, and in close contact with, the gas-carbon. Formerly the gas-carbon blocks were simply bored through and placed upon the copper-lead supporting shaft; but now short rounded blocks of Acheson graphite are employed to support the gas-carbon, in the manner shown in Fig. 3. The diaphragms last 30 to 40 days in constant work, and the anodes about the same period; the cost of renewing these portions of the cell is, therefore, a considerable item in the total working costs of the process.

The brine supplied to the cells is pumped, as already stated, direct from the company's own wells, and the supply of brine is so plen-

Process. Wet Processes.	E. M. F. Required in volts.	Actual yield in grams — Per amp.-hr. NaOH.	Cl.	Per kw.-hr. NaOH.	Cl.	Efficiencies, per cent. Cur.	Energy.
Castner-Kellner	4.0	1.363	1.136	340	284	91	52.3
Hargreaves-Bird (1)	3.4	1.196	1.057	351	310	80	54
Rhodin	5.0	1.349	...	260	...	90.2	41.4
Aussig "bell"	4.9	1.308	...	266	...	87.5	40.9
Theoretical figures	2.3	1.495	1.322	650	574	100	100
Fusion processes: Acker.	7.0	1.370	...	195	...	91.6	54.9
Theoretical figures	4.2	1.495	1.322	356	314	100	100

(1) The Hargreaves-Bird process is used only for producing carbonate of soda.

tiful that a large plant was erected in 1904 and is now at work producing fine salt for sale from the surplus brine. This plant is worked on the multiple effect evaporative system, and has a capacity of 30 tons of salt per day.

The chlorine gas is pumped from the anode cells by two pumps of special design to the bleaching powder chambers, which are placed at a considerable distance from the other portions of the works. These chambers are of the usual type (sheet lead supported on timber frames) and have a capacity of 20 tons of bleach per charge. The lime required for absorbing the chlorine is obtained partly from the CO_2 producing plant of the company and partly by purchase of the better quality of lime produced in the peak district of Derbyshire. Only soft-wood or "low-strength" bleach is produced at the Middlewich works, the normal output being about 150 tons from a weekly decomposition of 115 tons of salt.

As regards the efficiency of the Hargreaves-Bird cell and process, some figures bearing upon this are given below. In each case the calculations have been based on figures published by the inventors for the actual work of the processes on a commercial scale, and they are consequently of greater value than mere laboratory results.

Using the above figures, we find that to obtain one metric ton of 72 per cent caustic soda, by the various processes, the following number of kilowatt-hours are required, and that the relative costs of power for the processes are as stated in column 3 of the table.

Kilowatt hours required to obtain one metric ton of 72 per cent. caustic soda and the equivalent amount of bleaching powder by various electrolytic alkali processes.

Process.	Kilowatt hours.	Cost at ¼d. per kw.-hour.
Castner-Kellner	2733	£2.17.0
Hargreaves-Bird (1)	2649	2.15.2
Rhodin	3457	3.12.0
Aussig "bell"	3490	3.12.10
Acker (fusion process)	4769	4.19.4

(1) The Hargreaves-Bird process is only used for producing carbonate of soda.

Combined Telephony and Telegraphy.

At the Chicago convention last week of the National Interstate Telephone Association, Mr. Samuel G. McMeen presented a paper describing in detail the various methods of combined telegraph and telephone working in the same circuits. The author referred to the accompanying Fig. 1 as illustrating the fundamental principles of such workings. In this figure it will be seen that over a line of a single wire, using earth as a return, one telegraph and one telephone service may exist at the same time. Over a two-wire line, by one method of operation, one telegraph and one telephone service may be secured at the same time; and this may be accomplished in two different ways so far as the apparatus and principles are concerned.

By another method of working, a two-wire line may be made to furnish one telephone and two telegraph services at the same time. In all of these arrangements, under proper conditions, there is no interference between the two classes of service. The whole matter of superadding telegraph to telephone service on a one-wire line, or the reverse, may be dismissed by saying that it is not yet shown to be possible to do both things over a single wire without reducing in some degree the quality of the telephone service. The principal commercial application of such a plan is to convert the existing grounded telegraph lines into combined ones, thus securing telephone service of some value, without serious interference with the simplicity and convenience of the telegraph service. This is accomplished by the introduction of certain rather delicate apparatus for signaling, of more than usually powerful transmitters, and of receivers of less than usual sensitiveness. A little thought will show that circuits specialized in this way cannot be connected to the standard telephone systems of cities, so that this form of combined working must be considered special, though valuable. Combined working over two-wire or metallic circuit telephone lines, however, is free from this objection, and, indeed, from any other very serious ones.

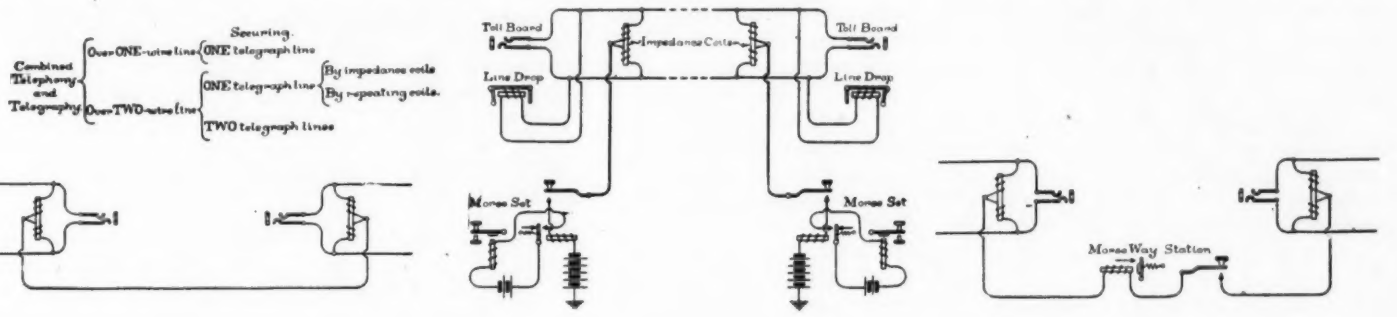
Any metallic circuit telephone line which is good enough for quiet commercial telephone service, may be made to furnish one telegraph circuit by having impedance coils bridged across it, as shown in Fig. 2. These coils should contain turns enough to enable them to be bridged across the circuit with no greater reduction in telephone transmission than would be caused by bridging across a high impedance standard drop or ringer. The magnetic circuit may be open or closed; that is, the windings may be upon a straight bundle of iron wires, or upon a ring-shaped core. A tap is to be taken from the middle of the winding, or, what is equivalent, from the junction of two similar windings on the same core. This tap is carried to the telegraph apparatus and may be considered simply to be the end of the telegraph line. Any desired arrangement of telegraph apparatus may be added to the circuit thus secured, the only limitation being that the method of working should not involve

high frequencies, such as are met in the Edison phonoplex or in any of the high-speed systems of automatic telegraphy.

Should it be desired to build up a telegraph circuit longer than the available metallic circuit, or to carry the telegraph circuit over a route not already provided with a telephone circuit, the tap for the purpose may be taken from the telephone pair through an impedance coil and into another pair in a similar way. This arrangement is shown in the tabulation of Fig. 3.

If desired, a telegraph set may be inserted at such a point as this, where the telegraph line transfers from one pair to another. Fig. 4 shows this condition.

Should it be desired to insert a pay-station in a telegraph circuit at a point which is not a terminus of a telephone circuit, condensers may be inserted in each of the wires, impedance coils bridged beside them, and the Morse apparatus inserted in the bridge wire which thus emerges from the pair. This arrangement is shown in Fig. 5.



FIGS. 1, 2, 3 AND 4.—COMBINED TELEPHONY AND TELEGRAPHY.

In all the foregoing plans involving the use of impedance coils, there exists the difficulty that in case the two telephone lines so equipped are switched together through a toll board having no condensers or repeating coils in its cord circuits, the two sets of Morse apparatus will be connected together and confusion may result, quite as does when two telegraph lines become crossed. Inasmuch as condensers of two mf. or greater capacity do not interfere with successful telephone transmission, cord circuits so equipped will be free from this fault. For the same reason the loop arrangement shown in Fig. 5 is free from any telephonic objection.

There is another fault in the impedance coil plan, in that ringing generators, suitable for local exchange line signaling, often require to have one terminal permanently grounded, or to have temporary ground applied during the time signals are being rung upon party lines, grounded rural lines, or other circuits involving ground in any way. If the same source of ringing current is used for toll line signaling, a little thought will show that the telegraph outfit will frequently be disturbed by a series of dots, caused by ringing current passing to ground through the Morse relays.

A preventive for such a derangement is found is providing separate ringing apparatus for toll operators, or by securing the ringing current for these operators through special transformers.

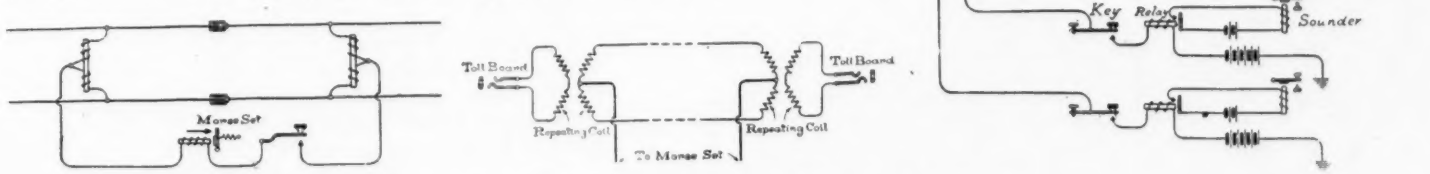
Roughly speaking, the best conditions of operation with the impedance coil plan will be secured when, with a high resistance total Morse circuit, high resistance telegraph relays are used. It is not required that the resistance of the impedance coils be great, but only that their inductance and consequent choking due to voice currents be great. This is an immediate result of the iron core and the turns. For an expedient, a ringer may be used as such a choke coil, its two terminals being bridged across the telephone line, and a telegraph tap taken by extending the junction between the wires of the two spools. Such an arrangement, if the spools are at all nearly equal, will be quite successful. If a number of circuits are so treated, the ringers of the different circuits must not be stored close together with their cores parallel, or cross-talk between the circuits may result. This may be prevented by placing the adjacent ringers with their cores at right angles to each other.

It is obvious that a high impedance tubular drop having a middle terminal may also be used for such a telegraph tap, and in such a case danger of cross-talk disappears, being prevented by the shield.

If such high impedance devices as ringers and drops are used for these taps, the Morse relays should be wound to high resistance, say 500 to 1,000 ohms.

By the use of repeating coils to be permanently inserted in the telephone line at the points where the telegraph tap is to be taken from the circuit, one Morse line may be secured from a two-wire circuit quite as has been described for the use of impedance coils. Fig. 6 illustrates how the tap is taken from the line side of the repeating coil. Coils may be secured in the market with arrangements made for taking out this tap. Connections to Morse apparatus are quite the same as are shown in Figs. 2 and 4. This arrangement has the advantage that no connections between telephone lines in the way of ordinary switching, nor any peculiarities of ringing apparatus, will affect the telegraph apparatus adversely. It has the disadvantage that the introduction of two repeating coils in a circuit causes a distinct loss in both voice and signal transmission, all the more marked when several lines so equipped are connected together. From the practical standpoint, this plan is not recommended for other than short lines, and then only under excellent conditions where freedom from interference is the thing most greatly to be desired.

The reason for non-interference between the telegraph and telephone services in either the impedance coil or repeating coil plans is that at any point where telephone apparatus connects to the two wires of the circuit, the potential difference of the two wires due to telegraph currents is always zero.



FIGS. 5, 6 AND 7.—COMBINED TELEPHONY AND TELEGRAPHY.

The arrangement of things shown in Fig. 7 is that which gives two telegraph circuits in addition to one telephone circuit from each pair of wires. The drawing shows the situation far more clearly than it can be described in words. The principle involved is that of different frequencies, the pulsations which make up the telegraph signals being very much slower than those of the voice currents. When it is remembered that this drawing shows the equipment at one end of the line, and that the distant equipment is an exact duplicate; that the impedance coils *a a* are capable of passing telegraph impulses with little or no harmful effect upon them; that these coils further act with such a choking effect upon voice currents as to be practically opaque to them, and that

the condensers of 2 microfarads each are relatively transparent to alternating currents and opaque to direct currents, it will be easy to see how the two systems of communication can go on at the same time.

A close examination of the drawing will show that the direction of windings in the coils *a a* is such that the two halves of the total winding are connected in the familiar differential or reverse relation to each other. It will also be noticed that this is not true of the coils *b b*. In the coils *a a*, therefore, so far as direct currents are concerned, the magnetizing effort of one winding of each complete unit neutralizes that of the other; and this is also true for direct currents, even if interrupted at the highest frequency used in telegraphic hand work; but for currents of such high frequency and small volume as those of speech, the windings of each unit are practically two independent choke coils in series.

While the other arrangements which have been discussed secure non-interference between the two systems of communication by preventing the telegraph from producing any effect at all in the telephone receivers, this plan operates to modify the telegraph signals in such a way that, although they affect the receivers, they do not produce audible sound. A careful examination of the diaphragm of a receiver properly connected across a composite line while the telegraph is working, will show that it is moving through a considerable range, even though nothing whatever can be heard when the instrument is held to the ear.

Each of the plans has some disadvantages. The flaw in this plan is that the shunt across the circuit through the coils and condensers is sufficient to prevent any ordinary ringing. Signals from one station to another require to be given over some Morse line, or by the assistance of special apparatus adapted to respond to currents of very high frequency. As the voice current is of a high frequency and can pass over the pair, so some other high frequency, but of larger volume, may be used to operate a relay at the distant station, and that in turn to display a signal. There is, however, no simple and convenient arrangement available.

The ordinary ringing current is of sixteen cycles per second; a skilled telegraph operator will send thirty-two dots per second; the half waves of the ringing current are less abrupt in change than the telegraph dot. For these reasons it is apparent that one may send ringing current instead of telegraph current over any composite Morse line without interfering with the telephone. This possibility enables one to sell the service of one side and retain the other for ringing. The arrangement of keys and signals is obvious.

Telegraph circuits secured in any of these ways may be treated as may be desired within reason, in the way of extending by repeaters.

There are three reasons why it is commercially of advantage to apply these composite methods to some of the circuits operated by almost any long-distance organization.

One of them is to secure an additional earning from the property, because by the very nature of things the lines are practically out of use during a large part of each total day. It is not found difficult to secure an annual telegraph revenue equal to 5 per cent on the total cost of the circuit, and this without establishing offices or maintaining a special organization to care for commercial messages.

There is more demand for telegraph service in its private line form than is being fulfilled by all the existing telegraph equipment. An active canvass of commercial interests in one's locality, and particularly of those having offices, factories and branch houses in different places, is certain to produce contracts, at a rate less than for other methods, which will supply the consumer with a better result than he is now securing.

The investment on the part of the telephone company per telegraph station, varies with the different plans, but in all cases is only about as great as the cost of the line and equipment of a telephone subscriber located a similar distance from the central office. This statement is meant to cover the complete equipment, including the telegraph apparatus required at the consumer's station.

The second reason is the advantage of ticker wires over which much or all communication between toll operators may take place. Naturally, this enables toll operators to prepare for one conversation over an important circuit, while another is going on. An intelligent use of such facilities will enable the carrying capacity of the more remunerative lines to be increased enough to defer the stringing of additional circuits.

The third reason is in the transaction of the official business of the telephone company. By its very nature such a company has its offices scattered about the country, and it is too often its tendency to overburden its own circuits with its official business during the day, while on certain routes there may be too few circuits to carry even the remunerative business of the public. It is inconvenient to force the official business into the less busy hours of the day. A very small investment in composite circuits, and a slight rearrangement of the company's organization, will enable an official to dictate telegrams which the stenographer herself, with a little knowledge of Morse, may place immediately upon the line. Such business may or may not be confirmed by mail. It is not essential that the operators be skilled to high speed, as training in accuracy only is sufficient, and even fifteen words per minute is a sufficient rate. Very fast operators reach sixty.

If it is not desired to extend the telegraph network over an entire system, official telegrams may be landed in important centers and transmitted by telephone to destination. Experience in this method of handling messages will show that errors are less frequent than might be expected.

Variable-Speed Dynamo.

In the Digest on page 898 of our issue for May 13 was given a brief description of the new variable-speed dynamo designed by Dr. E. Rosenberg. We give below a fuller account of the characteristics of the machine, supplemented by curves, showing the performance of the dynamo in actual service. As was stated in the article just referred to, the machine is built like an ordinary continuous-current dynamo, but has extra brushes spaced 90 electrical degrees between the main brushes and connected externally by a heavy conductor, and the armature reaction is intentionally made very strong, by the design of the machine. In fact, the cross turns are depended upon for the regulation of the dynamo.

The construction is diagrammatically indicated in Fig. 1. The armature is of the ordinary type and the dynamo is self-exciting, like any shunt-wound machine. In the diagram, however, it is shown connected to a battery to which it supplies current. The battery sends a current of constant strength through the field coils *ff*, which produce a "primary" flux indicated by *ss* and *nn*. This

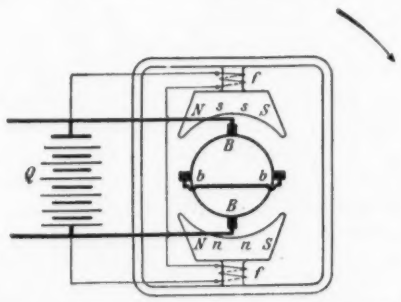


FIG. 1.—DIAGRAM OF VARIABLE-SPEED DYNAMO.

flux is mechanically in line with the brushes, *BB*. When the armature is in motion, due to the cutting of this flux by the armature conductors, there is generated at the auxiliary brushes, *bb*, an electromotive force, which sends current through the heavy conductor connecting these brushes, and there is produced thereby a flux which tends to place itself in mechanical line with the brushes, *bb*. This latter flux, which divides and passes obliquely into the pole tips, is indicated in Fig. 1 by *NN SS*. Since the armature conductors cut this flux, there is generated therein an e.m.f., which is effective at the brushes, *BB*. When the speed is sufficiently high this e.m.f. sends current *I* into the battery. Now this current *I* tends to produce through the armature a vertical flux opposite in direction to the main field flux. That is to say, the current *I* is opposite in magnetomotive force to the field current, and the resultant vertical flux is, thereby, reduced in magnitude. The short-circuit current between *bb* is thereby also diminished, likewise the horizontal armature flux and the voltage between *BB*. This leads to a reduction of the external current *I*, and consequently to a reduction of the vertical armature flux opposed to the "primary" flux, and so on until a final state of equilibrium is reached.

Since the whole action of the dynamo is primarily due to the

"primary" flux, *ss-nn*, it follows that the external current cannot possibly increase beyond a certain value, howsoever high the speed of the armature may become. The limiting value of *I* is that for which its magnetomotive force is equal to the magnetomotive force of the field current. It is evident, therefore, that there corresponds a certain value of *I* to every value of the field current. The fact that the compensation for speed depends upon the differential action of two practically equal quantities, is the principal reason for the extremely exact automatic regulation which is obtained with these machines.

Fig. 3 shows whiat might be called the external characteristics of these machines working in parallel with a battery, i. e., with constant external voltage. The various characteristics are obtained with different exciting currents in the coils *ff*. Starting with curve *I*, which represents the working of the machine with maximum excitation, it is seen that at about 340 revolutions, the terminal voltage of the machine becomes equal to the battery voltage, and that the current supplied by the machine increases rapidly as the speed increases above this point. When a speed of about 700 revs. per min. is reached, the current attains practically a maximum, since the curve runs asymptotically toward a definite limiting current. Thus a change of speed from 2,400 to 800 revolutions produces a drop in current of only about 12 per cent. Curves II to VIII represent the working of the machine with a smaller excitation in coils *ff*. At half excitation (curve V) the speed at which the battery voltage is reached is only slightly higher than before, and the maximum external current is almost exactly half that for full excitation.

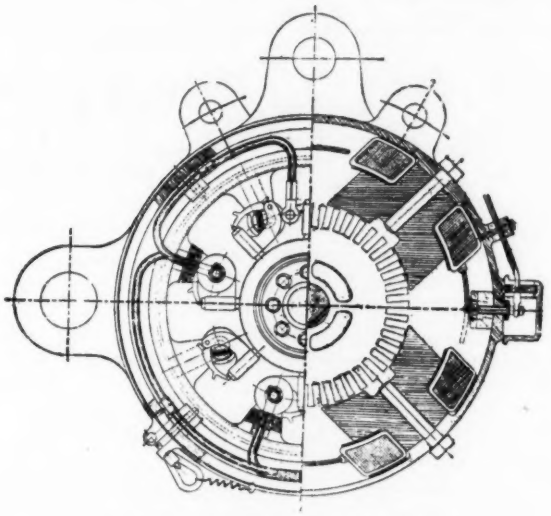


FIG. 2.—SECTION OF DYNAMO.

Fig. 4 represents the working of the machine directly on a constant external resistance instead of a battery. For a given exciting current both the current and voltage start, of course, from zero. After a speed of about 600 or 700 revs. per min. is reached the curves assume nearly exactly the same form as the current curve in Fig. 3, that is, both the current and the voltage remain practically constant. When working on incandescent lamps the effect of the speed variations is even less noticeable, owing to the fall in the resistance of the lamps as they get hot.

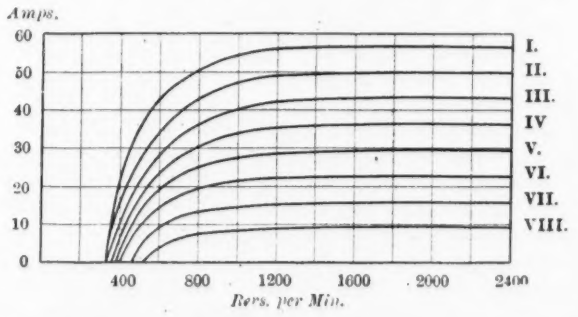


FIG. 3.—CURRENT CHARACTERISTICS WHEN FEEDING BATTERY.

In order to avoid the possibility of the short-circuit current, which rises rapidly as the speed increases, from reaching a dangerous value in any case, it is found advisable to let the iron of the magnet core become saturated when the flux reaches a value corresponding to the maximum safe short-circuit current. Then, if the speed falls below that corresponding to this point, the short-circuit current will decrease, until finally the voltage of the machine will fall below that of the battery. To prevent a current from being sent back from the battery through the machine a reverse-current cut-out is inserted between the two.

Fig. 2 is a cross section through a four-pole dynamo designed for train lighting, and serves to indicate the method used for obtaining abnormal armature reaction. One of the most important points in connection with this type of dynamo is, of course, the commutation. The short-circuited brushes are working in the neutral zone, and are thus in a relatively better position than are the brushes of any reversing motor, more especially so as the current flowing through the short-circuited brushes is only about 40 per cent of the full-load current. Besides, the current in the short-circuited brushes decreases with increasing speed, so that the product of commutated current and speed which determines the reactance

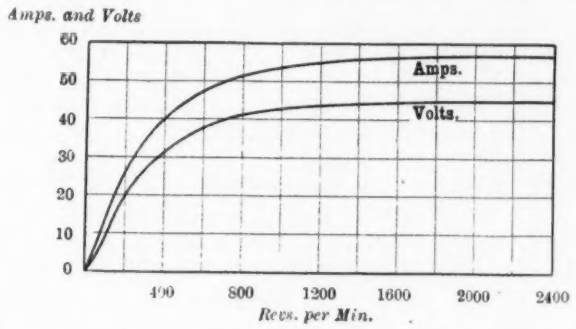


FIG. 4.—CURRENT CHARACTERISTICS WITH CONSTANT EXTERNAL RESISTANCE.

voltage is nearly constant for all speeds. Thus it will be seen that the commutation at the short-circuited brushes is equally good with low and high speeds. The main brushes, *BB*, are in the centre of the "primary" flux, but in the neutral zone of the horizontal armature flux. Now the "primary" flux is always only of such an amount as to produce a certain limited current through the resistance of the armature and the short-circuited brushes, and the separate short-circuiting of a few sections by the brushes, *BB*, cannot cause anything more than this limited current to flow. As a matter of fact the coils, *ff*, may be considered as compensating coils, neutralizing and overpowering the armature ampere-turns due to the external current. This compensation, however, is not a very exact one, because, as the external current increases, the amount by which the ampere-turns of the coils *ff* exceed the armature ampere-turns falls off instead of increasing. For this reason, and in order to allow for a slight lack of magnetic symmetry in the main flux, it has been found advantageous to cut slots in the pole faces just opposite the brushes *BB*; the commutation of these brushes takes place in a real neutral zone. Thus, also, the brushes *BB* work under exactly the same conditions as the brushes of an ordinary reversible motor, and have been found to work absolutely sparkless when running in either direction and with any speed.

Considering the field magnets, a considerable amount of material is saved here. The main flux being produced in the armature and flowing from the latter into the air through the pole-shoes and back to the armature, the iron of the pole shoes has only to be of sufficient section for this flux. The magnet frame and the cores have only to carry the small "primary" flux produced by the coils *f f*, and can, therefore, have an extremely small section.

It is stated that the efficiency of the new machine is about the same as that of an ordinary dynamo of the same output. The commutator losses are slightly larger, but this additional loss is compensated by the smaller excitation loss. The efficiency at a given output remains practically constant over a wide range of speed, for the increased friction losses at high speeds are compensated by the reduced loss in the short-circuit.

Among the railway authorities which have made extensive orders for this machine are the Prussian State Railways, the Bavarian State Railways and the Bagdad Railway.

Letter to the Editors.

Booster Field Control.

To the Editors of Electrical World and Engineer:

Sirs:—I have been somewhat interested in the article entitled "Booster Field Control," by Mr. Carl P. Nachod, which appeared in your issue of June 21. The type of rheostat and connections which are described have been in use for the control of storage battery boosters at least eight years, and have several times been described in print.

Mr. Nachod's graphical method of computing the resistances of the successive steps in the rheostat is new and ingenious. It, however, involves too much calculation combined with the graphical construction, to make it an easily-handled, accurate method in practice. An analytical formula suitable for slide rule computation is simpler, more expeditious and accurate.

Mr. Nachod suggests that the best form of rheostat for booster control would be one provided with connections and a switch so arranged that it would act as a potentiometer through a portion of its range, and as a series resistance through the rest of its movement. In this opinion I heartily concur, and so favorably have I viewed this particular arrangement that about two years ago I patented it.

New York, N. Y. Lamar Lyndon.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Temperature Curves of Field Coils.—Glazebrook.—A communication with respect to the two papers of Rayner and Goldschmidt, abstracted some time ago in the Digest. Goldschmidt had called attention to the fact that all curves of Rayner are parabolas. The present author shows theoretically the reason for this and reaches a conclusion of practical importance to the effect that by a series of experiments on one coil, makers can determine with ample accuracy three constants—the internal thermal conductivity of the insulating material and the exterior thermal emissivities of the two surfaces—and can therefrom deduce the thermal conditions which will prevail in other coils not altogether dissimilar in pattern.—Lond. *Elec.*, June 16.

Eddy Current Losses in Solid Pole Pieces.—Ruedenberg.—A translation in abstract, but of considerable length, of his German paper recently noticed in the Digest.—Lond. *Elec. Rev.*, June 16.

Electromagnetic Field in Machines.—Emde.—The first part of a highly mathematical paper on the stationary electromagnetic field in the air-gap between two concentric hollow iron cylinders which may represent the stator and rotor of an electric machine.—*Zeit. f. Elek.*, (Vienna), June 25.

Lights and Lighting.

Standardizing Arc Lamps.—Norden.—A paper read before the recent annual meeting of the German Association of Elec. Eng. The speaker requested the coöperation of the association with the Association of German Electricity Works for devising methods of standardizing arc lamps. In the first place it is necessary to get a uniform formulation of all statements as to illumination. With arc lamps it is usual in Germany to give the mean hemispherical intensity. On the other hand the Reichsanstalt recognizes only the spherical intensity in its tests. Further, there should be a standard rule how to take into account the light absorption due to glass globes. It may be considered correct to test arc lamps without globes and to take the absorption into consideration by conducting a certain percentage according to the kind of glass used. On the other hand, the light emission with the globe is really that feature which characterizes the lamp in practical use. The economy of lamps, indicated by the watts consumed per candle, should also be clearly defined. As a matter of principle it is correct to measure simply the electrical power consumed at the terminals of the lamp when giving a known illumination. On the other hand, this principle neglects the consumption of a certain power in series resistances if such are necessary. Flame arc lamps for direct current are adjusted to an e.m.f. at the arc of about 47 volts, while ordinary direct-current arc lamps are adjusted to 42 volts. For the same current, therefore, the watt consumption of both lamps would be different. Nevertheless, if the supply voltage is 110 or 120, not more than two lamps can be connected to the network in either case, so that in practice both arc lamps would consume the same power. However, the latter consideration would not lead to a characterization of the economy of an arc lamp, since different values would obtain for the same type of lamp if it is in one case connected to a 110-volt supply and in the other case to a 120-volt supply. Another important point which should be decided is a uniform method of photometric measurement. Great complications are here due to the fact that the reliability of usual measurements is impaired by the difference of color of the lamp tested and the lamp of comparison. Moreover, in arc lamps with inclined carbons, the illumination is not symmetrical around the axis of the arc lamp, so that the usual test in one single vertical plane is no longer sufficient. The German Association of Elec. Eng. appointed a committee which shall take up the problem of standardizing electric lamps in general. This committee was instructed to act in coöperation with the Association of the German Electricity Works as far as arc lamps are concerned.—*Elek. Zeit.*, June 22.

Power.

Power Transmission Line in Nevada.—Prince.—An account of the electric power transmission of the Nevada Power, Mining & Milling Co., from the Bishop Creek in Inyo County, Calif., to the Goldfield and Tonopah districts of Nevada and the interlying towns and mining districts. The power developed at the hydraulic plant will be 3,500 hp, and a combined efficiency of the system of 60 per cent is assumed. It is expected that 2500 hp. will be delivered in Tonopah and Goldfield without too much of an overload.—*Eng. News*, July 6.

Belting.—Carle.—An article illustrated by diagrams on the power transmitted by belting.—*Power*, June.

Some Things Encountered in Power Plants.—Cavanagh.—A short article containing many practical hints on the care and operation of various pieces of apparatus found in a power plant.—*Amer. Elec.*, June, 1905.

Traction.

Single-Phase Traction in Paris.—Reyval.—The French Thomson-Houston Co. has constructed for some time single-phase motors of various frequencies for elevators, machine tools, etc. These motors, which are based on the principles of the patents of Latour and designed by Gratzmueller, have proven so perfectly satisfactory that the same type of motor is now used for a single-phase traction experiment on a street railway line in Paris. One single car is used for this purpose, making round trips on a line one mile in length. It is an ordinary direct-current tramway car; from its truck the two direct-current motors have been removed and replaced by single-phase motors; the controller has also been changed. The two motors are connected to the axles through a gearing which reduces the speed in the ratio of 4.6 to 1. Each motor has four poles and has a capacity of 50 hp. at 300 volts and 25 periods; its weight is 1,350 kg.; the maximum increase of temperature at the end of one hour of service is 75 deg. C. It is composed of a stator with distributed winding, absolutely analogous to the stator of a single-phase induction motor. Within this stator revolves the rotor, the air-gap being 2 mm. and the construction of the rotor being quite similar to the armature of a direct-current motor; the only difference is that in the experimental motors under test the commutator has been made large and constructed with considerable care in order to obtain perfect commutation. The commutation problem presents the greatest difficulty with single-phase series motors for the reason that in ordinary series motors the flux of the stator induces in the coil short-circuited by the brushes static e.m.f.'s of the form $e \cos \omega t$ and the flux of the reaction of the armature while running generates dynamic e.m.f's $e \sin \omega t$. These two e.m.f's are added to each other and produce, under the brushes, currents which render the commutation bad. One solution for improving the commutation consists in plac-

ing on the stator a winding which generates at any moment magnetic motive force equal and opposite to that of the rotor, so that their effect is suppressed. This method gives a compensated series motor. Another solution devised by Latour and used by the French Thomson-Houston Co. consists in utilizing the perfect commutation of the repulsion motor during running, and to combine with it the advantage of the series motor of having a strong starting torque. In both cases there is at starting a tendency to sparking, if the commutator is not carefully designed. The four-pole motor has eight brushes, four short-circuited and four introducing the current into the rotor. The two motors of the car are permanently connected in series and are fed from an oil-cooled transformer placed between the two axles and having a total weight of 1,100 kg; its design is probably too liberal. The secondary winding has a certain number of terminals from which the current may be tapped in order to vary the potential difference at the motor terminals for the sake of speed regulation. The secondary voltage corresponding to the highest speed is 300. Fig. 1 shows the equipment of the car

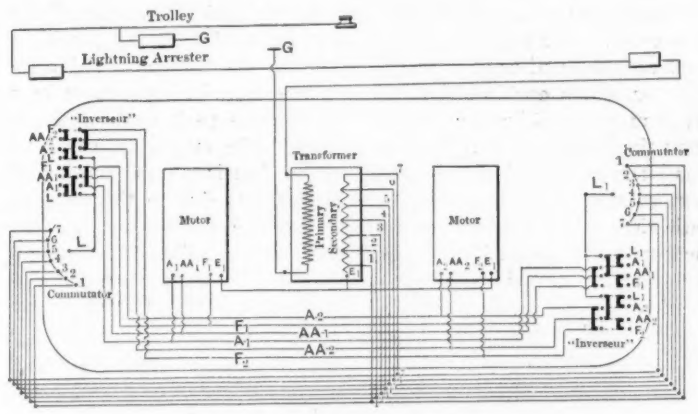


FIG. 1.—DIAGRAM OF CAR WIRING.

with a controller at each end. The primary current passes from the trolley wire through two circuit-breakers at the front and back of the car to the primary of the transformer and then to the rails. In shunt with the conductor leading from the trolley is a lightning arrester. Each motor has four terminals, of which one is connected to the fixed terminal of the secondary winding of the transformer, while the other three are connected to the three corresponding terminals of the "inverseurs." The regulation of speed is obtained by the controller, which contains a commutator with seven contacts so that different connections may be made as indicated in the diagram. Before the motors were placed on the car they were subjected to very severe tests, without showing the slightest tendency to sparking. It is believed their design has been unnecessarily liberal and that even if the dimensions of the commutator and the general dimensions of the design are reduced, and the air-gap is made much larger, the Latour motor will still be equivalent to the best direct-current traction motors. The tests have indicated a complete success.—*L'Eclairage Elec.*, June 24.

Single-Phase Traction in Germany.—SCHIMPFF.—A paper read before the annual meeting of the German Assoc. of Elec. Eng. The author first gives a review of the coöperation of the German government with electric manufacturers in the development of heavy electric traction. He then sketches the equipment of the Hamburg road, from Blankenese to Olsdorf, which is now in course of erection. The single-phase system will be used and steam turbines of the Brown-Boveri-Parsons system will be installed in the power station. There will be five turbines each of 1,250 kw. normal capacity, and of 1,700 kw. maximum capacity; also two turbines each of 600 kw. for lighting. The number of revolutions of the turbines will be 1,500. The 1,250 kw. turbines drive each a two-pole dynamo, giving single-phase, alternating current of 6600 volts at a frequency of 25, the power being 1,250 to 1,700 kw. at a power factor of 0.75. The lighting dynamo gives a current of 6600 volts with a frequency of 60. The road, which has a length of about 14 km., with some considerable grades, will be supplied with current at 6600 volts. There are four feeding points. To one distant part of the line the current is transmitted at 20,000 volts and then reduced to 6600. The construction of the trolley wire is the same as on the Spindlersfelde road. The rails are used for the return current. Double cars, each car having three axles, will be used with a controller stand at the front and one at the back. Each of the two cars has one truck and one driving axle. The trucks are placed at the beginning and end of the double car. One truck is provided with two motors, the other truck with one 125-hp. motor. Such a double car will have seating capacity for 118 passengers and will have a total weight, including passengers, of 180 tons. Each train will be made up of two or three such double cars. Finally some data are given comparing the cost of this single-phase system with a direct-current system with three-phase transmission and converter sub-stations. The total cost of conductors, transformers, converters, for the latter system would be more than double that of the single-phase system ($729,000 against $316,000). On the other hand, the weight of the alternating-current cars is higher than that of the direct-current cars, by about 7.5 per cent, so that the consumption of power is correspondingly greater. Both the direct-current line and the alternating-current line were calculated in such a way that in the former case the voltage drop from the sub-stations and in the latter case the voltage drop from the power house and the train should not be more than 10 per cent. With the combined three-phase and direct-current system there is also the energy loss from power house to sub-stations, which is calculated to be about 20 per cent on the average. It is thus found that the mean load at the power house will be about 12.5 per cent smaller with the alternating-current system, in spite of the greater weight of the trains. Nevertheless, the capacity of the turbines and dynamos must be made higher, since there is no storage battery which would equalize the load. It is finally claimed that the combined three-phase and direct-current system, in comparison with the simple alternating-current system, would require annually an expense of about $29,000 greater, which is 23 per cent of the annual cost of power generation and distribution (about $125,000).—*Elek. Zeit*, June 22.

High-Tension, Direct-Current System for Traction.—See the abstract under Installations.

Electric Rail Welding.—See the reference under Miscellaneous.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Series Direct-Current System.—The Compagnie de l'Industrie Electrique et Mecanique of Geneva (Thury system) has received the order for installing the power transmission plant for supplying the street railways of Lyon. Between the power plant at Montiers in Savoy with a capacity of 6,500-hp. and Lyon there is a distance of 180 km. Direct current at 57,000 volts will be used. The arrangement is shown in Fig. 2. The power plant will contain four groups of

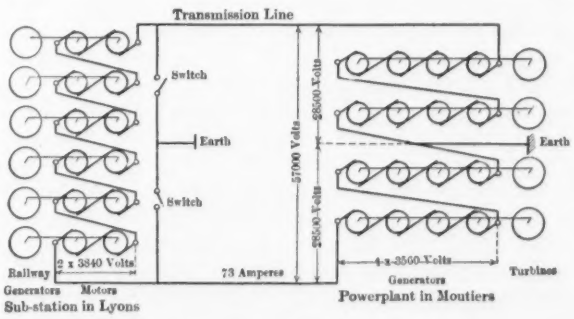


FIG. 2.—SERIES DIRECT-CURRENT SYSTEM.

machines. Each group consists of one 15,700-hp. turbine directly coupled with four direct-current generators each of 3,560 volts and 73 amperes. The generators are in one group and all the groups are connected in series so that the voltage at the outside terminals is 57,000. The sub-station at Lyon will contain six groups of motor generators, each consisting of two 73 ampere, 3,840-volt motors and one railway generator. All the motors are connected in series. Originally the intention was to use the earth for the return, but this was abandoned, although experiments in this direction had been quite satisfactory. The earth will now be used only for reducing the voltage of the conductors against earth to 28,500. For this purpose the centre of the system in the power station and the centre of the system in the sub-station are earthed. The cost of installation with this method was found to be not higher than if the earth had been used for the return, since in the latter case a stronger insulation against earth would have been necessary. An advantage of this arrangement is that the earth may be used as a reserve conductor

whenever a defect develops within one line conductor. For this purpose two switches are provided in the sub-station, as shown in the diagram. Of course, in such cases, only one-half of the generators in the power plant and one-half of the motors in the sub-station can be used.—*Elek. Zeit.*, June 15; from *Bull. de l'Assoc. Montefiore*, April.

South Africa Central Station.—An illustrated article on the new direct-current municipal station which is being erected at Johannesburg. The station, which is not far from the centre of the town, will supply a three-wire, direct-current system in the central district, and will also supply the tramways with direct current without transformation, the dynamos being available for either purpose. The very large outer or residential area will be supplied by two-phase alternators at 50 periods per second at 3,000 volts, the distribution being mostly single-phase. The generating machinery aggregates 13,000 hp and consists of three 1,350-kw continuous-current generators, two 675-kw continuous-current generators, two two-phase 1,350-kw alternators, and one two-phase 675-kw alternator. Their construction is described and illustrated.—Lond. *Elec.*, June 9.

Motor-Controlling Apparatus.—APPLETON.—A short article in which the author points out the need of further improvements in motor-controlling apparatus.—*Amer. Elec.*, June, 1905.

ELECTROPHYSICS AND MAGNETISM.

Hysteresis.—At the last meeting of the German Association of Electrical Engineers, Epstein presented the report of the hysteresis committee. The committee has reached the conclusion that the three industrially developed instruments for iron testing, namely, those of Epstein, Moellinger and Richter, should be admitted for engineering tests. In giving the "loss figure," it should be stated which instrument was used for the measurement. Concerning the ageing of iron, the committee has introduced the term "ageing coefficient," which is defined as the percentage increase of the loss figure after 600 hours' heating to 100 degrees C. The Reichsanstalt will undertake a systematic study of the total field of the relations between magnetization and chemical composition, which is expected to require 4 or 5 years.—*Elek. Zeit.*, June 22.

Genesis of Chemical Elements.—According to J. J. Thomson an atom is a structure of shells of negative corpuscles within a sphere uniformly charged with positive electricity. The atoms of different elements are all made up of the same kind of electrons and differ among themselves only in the number and configuration of the electrons. It is, therefore, no longer absurd to consider the possibility of the transmutation of chemical elements. Moreover, the facts of the radioactivity strongly suggest that such a transmutation is actually going on. According to Rutherford and Soddy, the atom of a radioelement suffers spontaneous disintegration and passes through a succession of well marked stages (metabolons), accompanied in most cases by the emission of alpha rays. By various recent researches, especially of Ramsay, Boltwood and Soddy, one such disintegration series has been determined, as follows, the figures in parentheses representing the atomic weight: The parent is uranium (238), metabolons are radium (225) and polonium (212); the final element is probably lead (206.9), or possibly bismuth (208.5). The alpha particles emitted during the different changes and causing the lowering of the atomic weight of the residue form helium. Editorially, attention is called to the fact that these radioactive changes are entirely spontaneous and that with none of our strongest agencies, like application of heat, etc., are we able to influence in the least the rate of change of radioactive processes. There is no experimental evidence whatever in favor of the hope that we might learn to bring about at will the transmutation of elements.—*Electrochem. and Met. Ind.*, July.

A New Radium Phenomena.—PETRI.—A note on a curious effect observed in taking radiographs of coins in a magnetic field. He placed a silver coin, a nickel coin and a copper coin side by side on a sensitive plate and nearly touching. Near them, at about 1.5 cm distance, he placed a bar magnet pointing towards the coins. Three other magnets were laid on this, each one projecting further towards the coins, and on the topmost one was placed an oblong preparation of radium bromide, weighing 10 milligrammes. The negative, when developed after an hour's exposure, showed an impression of the three coins and the nearest magnet pole. The impression was normal, except that the rays had not penetrated into the narrow channel separating the coins, the negative showing a kind of bridge between them, giving the appearance of the coins having become fused together. In addition, a rudimentary bridge appeared to start from the magnet pole towards the nearest coin. On repeating the experiment without the magnets, no bridges were seen, thus showing that the coins had not been affected themselves. Experimenting with various metals, the author found that the most pronounced effects were obtained with metals which lie far apart in the thermo-electric series, as between iron and nickel.—Lond. *Elec.*, June 2; from *Ann. der Physik*, No. 5, 1905.

Transparency to Hertzian Waves.—BUSCEMI.—An account of experiments in which he measured the transparency of various substances for Hertzian waves by means of a detector based on the magnetic principle adopted by Fleming. About a core of soft iron wires, 13 cm long, he wound a layer of paraffined cardboard and then a layer of insulated copper wire 0.2 mm thick. Then came another layer of cardboard and then another layer of wire, 0.47 mm thick. The inner coil magnetizes the core, and any wave passing through the outer coil demagnetizes it. The author constructed 14 of these small coils, joining the magnetizing coils in series and the demagnetizing coils in parallel. He thus was enabled to obtain a current due to the diminution of the residual magnetism of the iron cores. The secondary winding consists of 7,000 turns with a total resistance of 9,900 ohms. The author designed a special commutator which enabled him to insert the magnetizing current at a given moment while the induced currents due to it were excluded from the galvanometer. The next moment the magnetizing current was interrupted, and at the same time the electric waves arrived and demagnetized the iron. The induced currents due to this demagnetization were received in a very sensitive galvanometer. The measurements showed that vaseline oil was practically transparent for Hertzian waves. Next came petroleum, benzine, ether and distilled water, and lastly the acids.—Lond. *Elec.*, June 9; from *Nuovo Cimento*, Feb.

Electronic Theory.—LORENZ.—A long paper read before the Berlin Elec. Soc'y, in which the author summarizes the results and problems of the electronic theory.—*Elek. Zeit.*, June 22.

ELECTROCHEMISTRY AND BATTERIES.

Electrochemical Industries of Niagara Falls.—FITZ GERALD.—A paper in which the author discusses the development of the electrochemical industries of Niagara Falls from an evolutionary point of view and describes several new electrochemical products now made at Niagara. Among the latter is acetyvone, i. e., calcium carbide prepared in a special form for use in acetylene generators of very simple construction. Vanillin is made by oxidation of iso-eugenal, which is prepared from oil of cloves; the oxidation of the iso-eugenal is accomplished by ozonized air, the ozone being produced by silent discharges through air. The Acker Process Company makes, besides bleaching powder, carbon tetrachloride from their electrolytic chlorine, also tin tetrachloride and tin oxide. The Roberts Chemical Company electrolyze potassium chloride to get caustic potash at the cathode, besides chlorine at the anode and hydrogen at the cathode; the chlorine and hydrogen are combined to form hydrochloric acid. Sodium made by the Niagara Electrochemical Company is the starting point of certain important new derivatives. Thus sodium peroxide is now produced in fused form under the name oxone. In contact with water it develops oxygen in the same way as calcium carbide develops acetylene. On account of the absorption of carbon dioxide by the sodium hydrate formed on the decomposition of sodium peroxide, it is proposed to use oxone for supplying oxygen and absorbing carbon dioxide in cases such as arise for instance in submarine boats. Oxone is far more stable in air than sodium peroxide in the ordinary form. Other new compounds are calcium peroxide for sterilization and preservation of foods, for ageing spirits and wines and for therapeutic purposes; magnesium peroxide for sterilization of water; zinc peroxide for antiseptic dressings; sodium perborate, in contact with water, yields hydrogen peroxide and is, therefore, a strong bleaching agent. The Pittsburg Reduction Company now makes more aluminum than is made in all the rest of the world combined. The growth of the carborundum industry is indicated by the figures of output: ½ ton in 1891 and 1892 combined, 595 tons in 1896, 2,380 tons in 1903, while the future annual production is estimated at 3,970 tons. Carborundum fire sand is a very good refractory material under certain conditions. Carborundum powders have been used as a substitute for ferrosilicon in the steel industry. Carborundum is now proposed as a starting material (instead of silica) for making ferrosilicons. The

production of artificial graphite was 81 tons in 1897, 440 tons in 1900, 1,333 tons in 1904, and is estimated as 2,600 tons next year.—*Electrochem. and Metal. Ind.*, July.

Chemical Energy Transmission.—Chemical energy transmission consists in the transport of compounds with high chemical energy content to a distant place. Chemical energy transmission has two distinct advantages: first, it is not bound to a fixed route—it requires no line wires; second, it is not bound to a certain locality. Being stored latent energy, chemical energy may be set free at will when and where desired. An example is the aluminothermic reaction. Whether tramway rails are welded by thermit or the broken sternpost of a steamer is repaired by thermit, the energy for this purpose has been transported to that place from the electrochemical plant where the aluminum was made. Calcium carbide gives acetylene where and when it is wanted. Since chemicals with a very high energy content are required for chemical energy transmission, and since most of such chemicals require the agency of the electric current for their manufacture, many chief reagents for chemical energy transmission are products of electrochemical industries.—*Electrochem. and Met. Ind.*, July.

Electrolytic Deposition of Alloys from Mixed Solutions.—JACOBS.—An abstract of a paper on a method which is now used commercially by a lithograph company. In the simultaneous deposition of two metals from a mixed solution of their salts, the difficulty is met that the solution attacks and dissolves the more electropositive metal after deposition. This may be prevented by the use of two anodes, one of the more electropositive and the other of the more electronegative metal, connected to separate generators running at different voltages, the current returning through the cathode in the bath by a common third conductor to the generators. Alloys of zinc and nickel and of zinc and copper were deposited in this manner from neutral solutions. With cyanide solutions of copper and zinc a great variety of brass work was plated from the same, by changing the voltage on either anode in order to precipitate a brass running high in copper and low in zinc or vice versa.—*Electrochem. and Met. Ind.*, July.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Comparison of Mutual Inductances.—TAYLOR.—An abstract of an American Physical Society paper. The same alternating current is sent through the primaries of the two pairs of coils, and across the secondary giving the higher e.m.f. is placed a very high resistance—5,000 to 100,000 ohms. If this resistance be made up of two parts, r_1 and r_2, and M_1 is the coefficient of mutual inductance of this pair of coils, then the e.m.f. over r_1 may be made to balance the e.m.f. of the secondary of the second pair of coils. Or,

$$\frac{M_1\ (r_1)}{r_1 + r_2} = M_2,$$

where M_2 is the coefficient of the second coil. Balance can be obtained with a telephone, but a higher order of accuracy may be attained with an alternating-current galvanometer. For instance, for a mutual inductance of 0.035 millihenry the order of precision is about 0.1 per cent, while for as small a mutual inductance as 0.002 millihenry (the Tesla coil of a wireless telegraph sender, primary four turns, secondary two hundred turns) consecutive settings with different resistances for r_1 and r_2 agree to about 2.5 per cent. For higher inductances, of the order of a few millihenries, the order of precision is very nearly that of the resistance boxes used, i. e., 0.1 per cent.—*Phys. Rev.*, June.

Calculation of Measuring Instruments.—JANUS.—An illustrated paper giving exact instructions for the calculation of measuring instruments with revolving coils. Rules and formulas are given for the determination of the field strength of the permanent magnets, the torque and weight of the revolving coil, the construction of the springs and the construction of the windings.—*Elek. Zeit.*, June 15.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Resonance Effects in the Receiving Station of Wireless Telegraphy.—HETTINGER.—A discussion of the arrangement shown in Fig. 1. The lower end of the vertical wire is connected with two self-induction coils, their values, L_1 and L_1, being always identical. The terminals of these two coils are joined at point 2 and connected to earth. If the receiving station operates with a certain wave length, the values $L_1 L_1$ must be so chosen that they, in combination with the vertical wire, oscillate with the corresponding quarter wave length. Fulfillment of this condition gives the first resonance effect and the e.m.f. between 1 and 2 becomes a maximum. If a capacity C_1 is in parallel with the self-induction coils $L_1 L_1$ and if

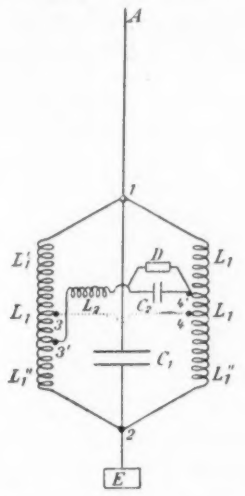


FIG. 3.—RESONANCE EFFECTS IN WIRELESS TELEGRAPHY.

the resonance condition $M^2 C_1 \frac{L_1}{2} = 1$ is fulfilled (where $m = 2\pi n = \frac{2}{T}$ and T the period of the oscillating currents), a second resonance effect is obtained. For the same total current entering in 1 and leaving by 2, the partial currents circulating in the parallel connected branches reach a maximum value. Between one winding of one self-induction coil, L_1, and any winding of the other coil, L_1, there is a certain e.m.f. of a certain frequency ($m = 2\pi n$). If between two such points (3′ and 4′) a self-induction L_2 and a capacity C_2 is inserted, so that the resonance formula, $m^2 C_2 L_2 = 1$ is fulfilled, a third resonance effect is obtained. If the wave inductor reacts on voltage or current, L_2 and C_2 are to be connected in series or parallel respectively. In the first case the partial voltages reach a maximum value, in the second case the partial currents. The wave indicator is shown in the illustration by D. By using these three resonance effects it is possible to get the most pointed resonance curve for operating the wave indicator. It can become of practical value, however, only by using the following method: "In order to enable the transmitted currents to act on the wave indicator, a current minimum or voltage minimum of the same is required. If the amplitudes of the resonance curve are uniformly suppressed until the maximum tuning value becomes equal to the required minimum for action, the maximum possible safety of selection is obtained." It is easy to find this minimum. Since the two self-induction coils, $L_1 L_1$, are perfectly equivalent in every respect and are, moreover, symmetrically arranged, there will always be the same potential in the two windings at analogous points, and also the same current. If the bridge consisting of $C_2 L_2$ and the wave indicator is connected between two such points, 3 and 4, the potential difference and the current flowing through the bridge is zero. The regulation of the active e.m.f. is obtained by inserting simultaneously one winding at the one side and taking out one winding at the other side. The branches which are in parallel with the bridge (3′ L_1', 1 L_1', 4′ and 3′ L_1'', 2 L_1'', 4′) then always retain the same value, while the potential difference between 3′ and 4′ may be increased at will. The minimum for which the wave indicator begins to act may, therefore, easily be found.—*Phys. Zeit.*, June 15.

Telephone Exchange Lamps.—In order to indicate at once whether one of the lamps in a telephone exchange is burned out, a German company makes a double filament lamp. Instead of the otherwise necessary resistance connected in parallel with the lamp, another high-resistance filament is inserted in the lamp in shunt with the ordinary filament. The auxiliary filament is not observed as long as the main filament is intact. When the latter burns through the auxiliary filament is heated to dark red heat. It has, of course, a longer life than the main filament.—*Elek. Zeit.*, June 22.

Miscellaneous.

German Association of Electrical Engineers.—The annual meeting has been held from June 4 to 8 in Dortmund and Essen. The number of members has increased during the last year by 215 and is now 3,636. The new president is Dr. E. Budde (Siemens & Halske Co.). In place of Gisbert Kapp, who has accepted a professorship, Chief Engineer Georg Dettmar was elected general secretary of the association.—*Elek. Zeit.*, June 22.

Electric Welding.—Some notes on a system of electric welding developed by a German storage battery company. An electric arc is used, which is formed at the place where the weld is to be made, between the part to be welded and a carbon electrode. The latter is carried along the line where the weld is to be made. The current is taken from a small generator in parallel with a storage battery. It is stated that the method is applicable to small repairs of castings and especially to the welding of electric tramway rails.—*Elek. Zeit.*, June 22.

Research Laboratories.—A plea for the erection of research laboratories in metallurgical and chemical works. An outline of their work is given.—*Electrochem. and Met. Ind.*, July.

Vanadium.—An article giving notes on various methods for the extraction of vanadium from its ores and on the properties of vanadium steels.—Lond. *Engineer*, June 9.

BOOK REVIEWS.

Elementare Vorlesungen Uber Telegraphie und Telephonie. Elementary Readings on Telegraphy and Telephony. By Dr. Richard Heinbrun. Berlin: Georg Siemens. Sixth Section. Pages 321 to 368.

We have already had occasion to review the preceding sections of this book. This section deals in part with the Morse system, and the Pollak and Virag rapid telegraph system; but is mainly directed to an exposition of the Hughes typeprinting telegraph. The description is clear and the illustrations are excellent.

The Hughes apparatus is not employed in America, but this section of the volume gives a good and clear description of the principal mechanical and electrical features of this well-known instrument.

Cement and Concrete. By Louis C. Sabin. New York: McGraw Publishing Company. 507 pages. Price, $5.00.

The increasing number of uses to which cement has been applied has naturally created a demand for literature in that direction, and the book under review attempts to furnish engineers and others with a working knowledge of that subject. Mr. Sabin has divided his book into four parts: the first, covering 27 pages, treats of the classification and manufacture of cements; the second, of 126 pages, covers the physical properties and methods of testing; the third, of 146 pages, the preparation and properties of mortar and concrete, and the fourth, of 142 pages, is on the use of mortar and concrete. In Part IV the author describes the various systems of reinforced concrete in use at present, and also discusses and furnishes formulæ for the design of that class of beams. It is to be regretted that the author has made such sparing use of diagrams in discussing the physical properties, or of illustrations of such articles as concrete mixing machinery, or descriptions of structures, etc., as such illustrations would much enhance the value of the book.

The data furnished by Mr. Sabin, there being more than 160 tables, are taken for the greater part from the tests conducted at the construction of the Poe Lock, at St. Mary's Falls Canal, Mich., at which the author assisted, and to which every writer on the physical properties of cements has been, in the past, obliged to refer.

In addition to this class of data, the author has, in his description of concrete construction, in nearly all cases, furnished items of cost—factors of necessity and therefore of immediate value to the designing engineer. The book in this particular, and in the vast amount of practical information which it contains, is of especial value to the contractor and to the engineer placed in charge of concrete work who has had little previous knowledge of the details of cement work. Indeed, the practical nature of much of the data and information renders the work suitable also to the needs of the master mason seeking for information of direct practical application only.

Direct-Connected Generating Unit.

The accompanying illustrations show a compact type of electric generating unit manufactured by the B. F. Sturtevant Company, Hyde Park, Mass. The set consists of a 9x8-in. single, vertical enclosed, automatic engine, direct-connected, with solid sub-base, extended shaft through bolted coupling and outboard bearing to a 25-kw. compound wound, direct-current generator. The engine is

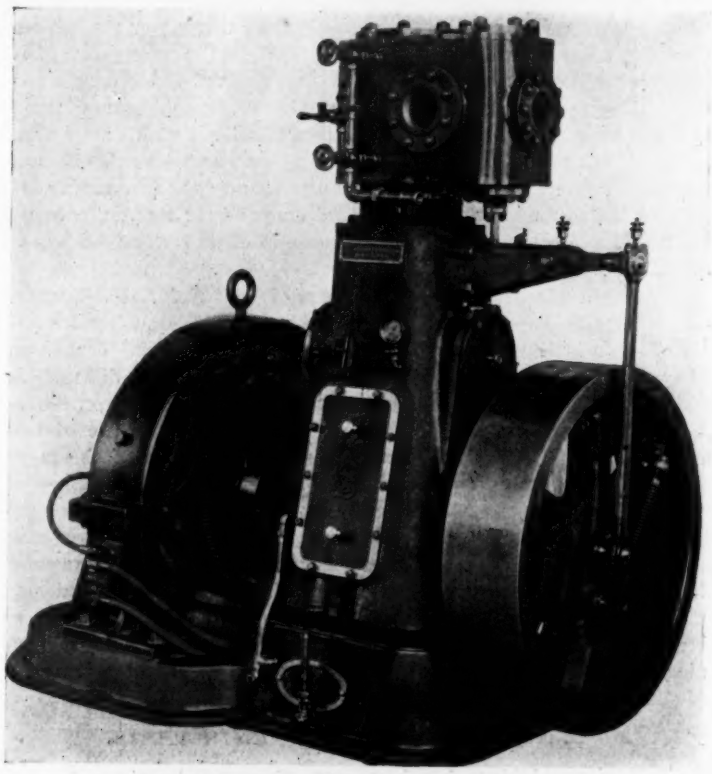


FIG. 1.—DIRECT-CONNECTED GENERATOR.

designed for a steam pressure of 90 pounds per sq. in., and operated at a speed of 350 revs. per minute.

The engine is equipped with an inertia governor of the Rites type, which regulates the speed within two per cent from no load to full

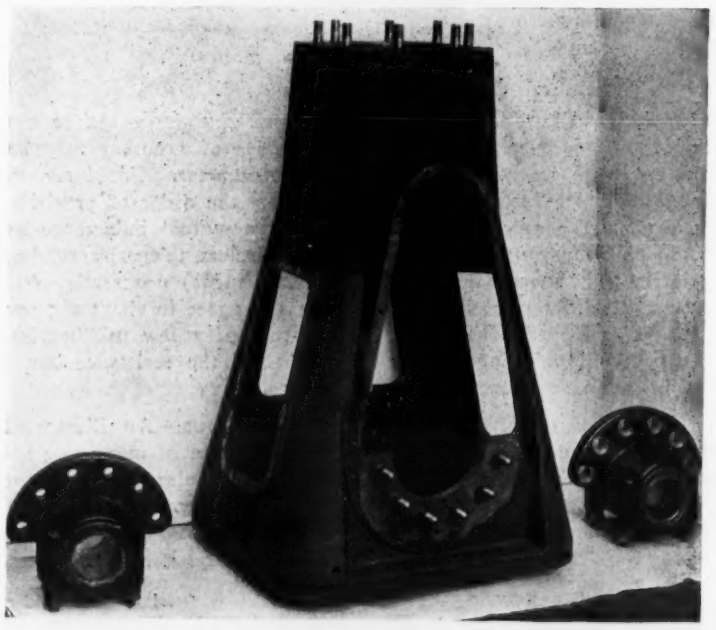


FIG. 2.—DETAILS OF MAIN BEARINGS OF ENGINE.

load. The cylinder is raised from the frame, and a stuffing box for the piston rod is fitted in the top. By this construction the oil is prevented from being carried into the cylinder on the rod, and the cylinder condensation cannot reach the oil in the frame; at the same

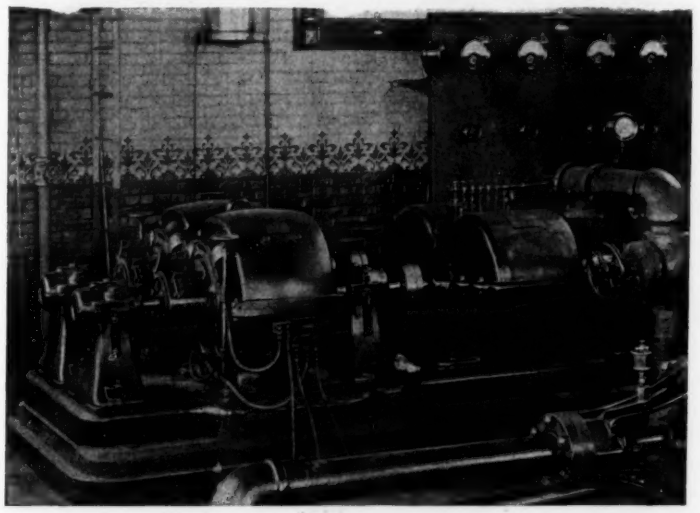
time, this arrangement gives ready access to the stuffing boxes while running.

The lubrication is of the type known as forced. An oil pump, operated from the main crank shaft, forces oil at a pressure of from 10 to 20 pounds per square inch into the main bearings, through the crank shaft, web, crank-pin, through the connecting-rod to the crosshead pin. Connection is also made from the oil pump to the main cross-head guides. This system of oiling serves not only to deliver oil to all bearings, but also to maintain under pressure a film of oil between the two bearing surfaces, thereby greatly reducing the friction and increasing the mechanical efficiency of the engine.

The generator is of the best mechanical and electrical construction. It is capable of carrying 100 per cent momentary overload without flashing at the commutator, with fixed brushes. An overload of 25 per cent can be carried for a period of two hours, without a temperature rise exceeding 50° C. above the surrounding air. The insulation is subjected to a test of 1,500 effective alternating volts for one minute, although the normal working e.m.f. may be only 500 volts.

The Durability of Steam Turbines.

An interesting test made upon a De Laval steam turbine which had been in use for two years was recently reported by Professors E. F. Miller and B. B. Lawrence of the Massachusetts Institute of



150-HP TURBO-DYNAMO.

Technology. The machine was built in the spring of 1903 at the Trenton shops of the De Laval Steam Turbine Company, and it has been constantly in service furnishing power and light for the New England Structural Company, East Everett, Mass. The installation is shown in the accompanying illustration.

An examination of the turbine wheel, buckets and pinions just previous to the test showed that there is no trace of appreciable wear. Many of the buckets still have some part of the original scale made during the process of drop forging.

Under a steam pressure of 152.9 pounds per sq. in. at the boiler, and 145.9 pounds below the governor valve, and a vacuum of 25.47 in. with the barometer at 29.9 in., the steam consumption was found to be 17.62 pounds per brake-horsepower per hour at an output of 160.4-hp. The guarantee under which the turbine was ordered stated that with a steam pressure of 150 pounds at the governor valve and a vacuum of 26 inches at the turbine, the steam consumption should not exceed 18.7 pounds per brake-horsepower per hour at full load of 150-hp.

It is to be noted that the turbine is still within the original guarantee, thus proving that the slight depreciation has apparently not affected the steam consumption.

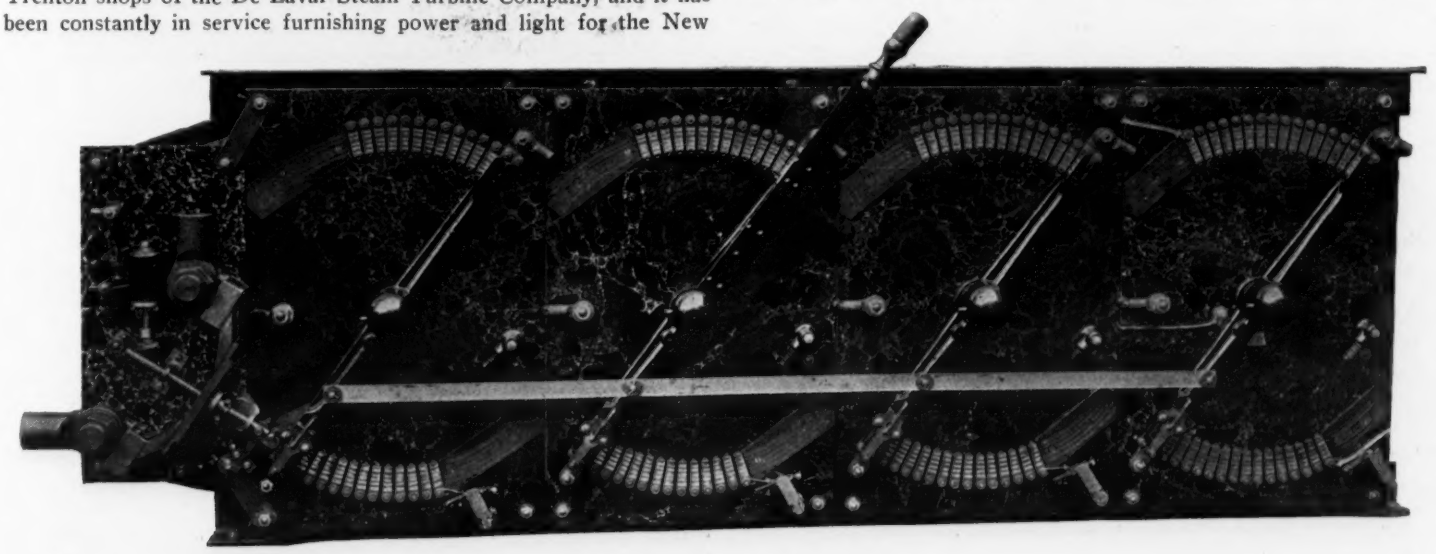
"No-Voltage" Release Motor-Starter.

The cut herewith shows a 200-hp, 125-volt, automatic, "no-voltage" release motor-starter manufactured by the Ward Leonard Electric Company, of Bronxville, N. Y. This machine is made up of four 50-hp starters, which are connected in parallel, and controlled by one master lever. Each starter is complete with its own resistance and switch. If at any future time changes of equipment demand it, an ordinary mechanic can readily increase or decrease the number of unit starters so as to adapt the starters to the exact condition of service. There are no magnets on any of the individual starters.

The starting levers are held at the short-circuit position by a latch which is tripped by the solenoid plunger upon the occurrence of "no voltage." This solenoid plunger is responsive solely to the line voltage and is entirely independent of the field or armature currents. At the short-circuit end of the starter there are two laminated contacts which short-circuit the lever, etc., and reduce the "watt" loss in the starter circuit to a minimum.

The material of the resistance is non-corrosive and not damageable by heating to a temperature of 150° C. or by salt air or salt water and does not materially change its resistance with rise of temperature. The starter will stand without injury a current of 50 per cent in excess of the full load motor current when passed through the entire resistance when cold for one minute. The starter will stand without injury or alteration a current which is double the full load motor current when passed through the entire resistance when cold for 20 seconds. The starter will not smoke or smell or deteriorate when tested as above.

To prevent arcing upon the circuit-closing contacts, there is furnished an auxiliary, independent, spring-operated, renewable circuit-closing switch, which makes the circuit with a quick make, and breaks the circuit with a quick break and magnetic blowout. All the stationary contacts are of segmental form, readily renewable and removable.



"NO-VOLTAGE" RELEASE MOTOR-STARTER.

The movable contacts are easily renewable and of the self-adjusting type, and able to ride over any projection standing 1/16 in. above the contact segments.

The resistance conductor is entirely enclosed in a solid fire-proof,

non-absorbent, insulating material. If the resistive conductor be fused by excessive current or otherwise, the arc is quickly and quietly extinguished without any attendant fire risk. The starter occupies but very little floor space, it being not more than 15 in. deep.

The d'Arsonval-Fulmen Storage Battery.

The different lead accumulator systems may be reduced, by careful elimination, to two: the Faure system of oxides pasted on a support and the Planté system of active matter formed at the expense of the support. Nearly all large manufacturers have adopted the Faure system and have condemned that of Planté (except in certain cases where lightness of construction is not essential) because of the difficulties of its formation and of its small specific capacity.

Within the past few years there has appeared a tendency to replace the Faure system by a mixed system by constructing the accumulator with Faure negatives and Planté positives. This change has been made because the duration of the Planté positive plates is incomparably longer than that of the oxide plates, while the principal reason of their systematic abandonment—their small specific capacity—can no longer be objected to after the progress made in France by Messrs. d'Arsonval and Vaugeois, who have obtained with the Planté plates the same specific capacities as those of the Faure plates.

The most conclusive proof on the duration of the d'Arsonval positive plates is found in the industrial working of the Parisian tramway services, where they have remained three years in service. On one of these lines it is specified that the batteries shall have a capacity of 50 ampere-hours at the average output of 50 amp.; the charging of the batteries is accomplished in about an hour. The positive plates of such an element weigh a total of 6 kg. Under these conditions they make easily 2,000 to 2,500 discharges before being put out of service. Such results have never previously been obtained.

The principles utilized by Messrs. d'Arsonval and Vaugeois to construct and form their electrodes are drawn from the following observations: When active matter is formed rapidly it falls; if, on the contrary, it is formed slowly, it becomes adherent, but the dimensions of the electrodes change, due to the change of volume that the lead undergoes in passing to the PbO_2 state. It will, therefore, be understood that in order to prevent the active matter from falling it is necessary to realize such a mechanical structure of the plate that this change in volume can take place freely. If two plates of lead having the same surface be compared, one non-formed and the other formed, it will be found that there is an increase of 5 to 10 per cent in the dimensions of that plate which has PbO_2 formed at the rate of 10 to 20 gr. per dm_2. If the dimensions of the plate had not changed it is evident that the active matter would not have formed or that it would have partially fallen. This observation is fundamental both for the construction as well as for the formation of the Planté plates. To profit by this the electrodes must be given a shape such that the changes of dimensions are provided for and controlled.

With the d'Arsonval electrodes, there are taken certain precautions that render the formed matter compact and impermeable to the sulphuric liquid, and this protects the underlying lead against an ulterior attack; when the lead has taken its definite form and is covered with a hard and dense coat of PbO_2 it has become almost proof against any attack of anodic products of electrolysis, or at any rate, much less so than would be the case with naked lead.

These ideas, of which the accuracy has been verified by industrial practice, resulted in the adoption of the Planté positive plates instead of oxide plates, and have been the origin of a real progress in the accumulator industry.

Below is given an outline of the process of manufacture of the Planté plates such as Messrs. d'Arsonval and Vaugeois have described it in comparing it with the processes in use up to the present time.

The problem to be solved for constructing a rational accumulator proposes itself in the following terms: Obtain with a given weight of lead the maximum surface, taking into account that the plate should present great mechanical solidity, and be easy to manufacture.

Two processes have been employed up to the present time to increase the apparent surface of a plate in creating thereon grooves and projections. The first process is by the fusion of lead in an appropriate mould. This process has numerous drawbacks: the unmoulding, if the grooves are narrow and deep, becomes difficult; the very delicate moulds necessary do not last long; the fineness of the projections being limited by difficulties of unmoulding, the maximum specific surface susceptible of being obtained by this process is soon attained. It is with great difficulty that a developed surface 15 times greater than the apparent surface of a plate 12 mm. thick can be obtained. The principal inconvenience of plates manufactured by fusion, however, is found in the fact that they carry in themselves the real cause of their destruction. Lead cast in moulds is, in fact, far from being homogeneous. It contains air bubbles in its mass and naturally deteriorates rapidly under the action of the peroxidation and the successive infiltrations of electrolyte; the plate is eaten through and through before the projections are completely worn, and thus put out of service before all the lead has been utilized. In melting down one of the disused plates, the fact that it still contains more than 60 per cent of primitive unoxidized lead may easily be verified.

The second process employed to make plates of large active surface is based on the use of a special cutting tool which, in cutting in on one side of the plate almost to its center, raises and bends

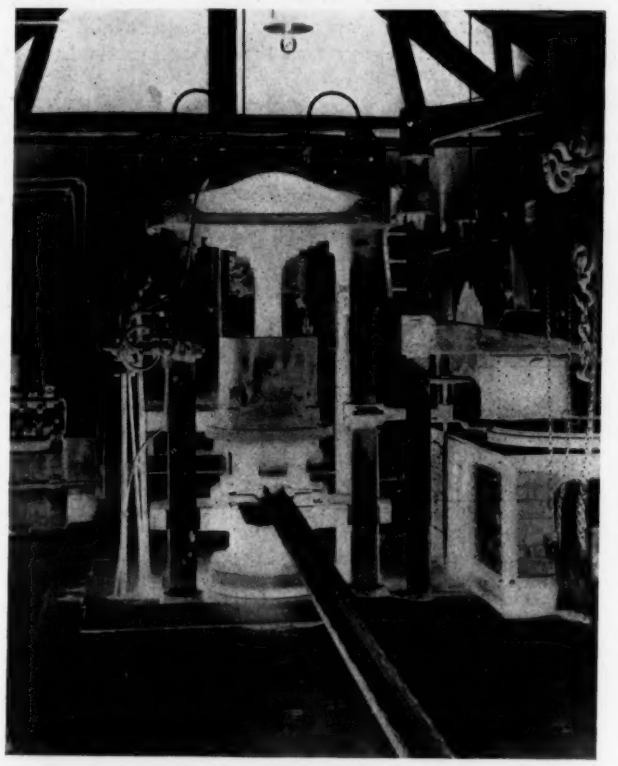


FIG. I.—MANUFACTURE OF LEAD PLATES.

the slips, which remain fast to the plate at one side, so that they stand out almost perpendicular to the surface of the plate. The action of the tool is very much like that of a plow. By this process there can be obtained a developed surface thirty-five times the apparent surface, and it is only in this respect that any progress has been made. The cast lead being always crystalline and not homogeneous, cannot be worked in this way, so that there had to be employed laminated lead of which the molecular cohesion is much greater and more regular. The use of laminated lead was believed to be of great advantage, because when subjected to electrolytic actions it wears out less rapidly and more regularly than the cast lead. But that which is true for lead in plates coming from the rolling mill is not true for the slips bent up on edge, as in this second process, for during the process the metal is bent and strained so as to destroy completely its original texture. This is especially true at the junction of the slip to the core of the plate; that is, at the point where it should have the greatest strength and uniformity. It is attacked very quickly at this point by the electrolysis, so that the body becomes worn through before the projections are completely peroxided. The result is that the plate is put out of service before all the metal in the raised slip has been used, and practically the life of this plate is not much superior to that of the cast plates.

The process employed by Messrs. d'Arsonval and Vaugeois pro-

duces electrodes of perfectly homogeneous lead, exempt from air-holes, very dense, and presenting developed surfaces attaining more than forty times the apparent surfaces. This process (Fig. 1) consists in principle of forcing the lead at a temperature approaching that of its point of fusion, through a special draw-plate under a pressure which may attain 2,000 kg. per sq. cm. This process is very similar to that used for making extended metal.

The draw-plates which are used in this manufacture are constructed by very simple mechanical processes, and are of such precision that grooves and slips as fine as can be wished for may be obtained. (For instance, 1/10 of a millimeter.)

The lead comes from the draw-plates in its definite form (Fig. 2)

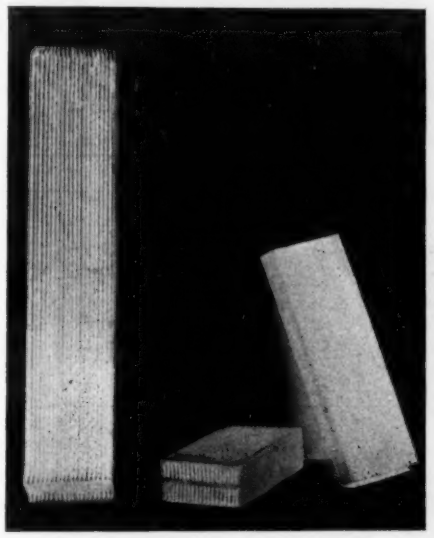


FIG. 2.—LEAD FROM THE DRAW-PLATES.

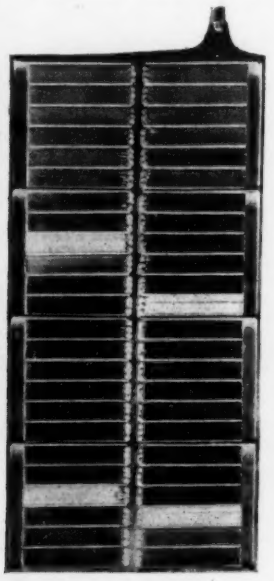


FIG. 3.—PLATE FOR SUBMARINE WORK.

without any supplementary handwork being necessary; it does not, therefore, lose any of the qualities given it by its manufacture at high pressure and heat.

The grooved bar which comes from the draw-plates is sawed into pieces of equal length which are soldered in frames of appropriate

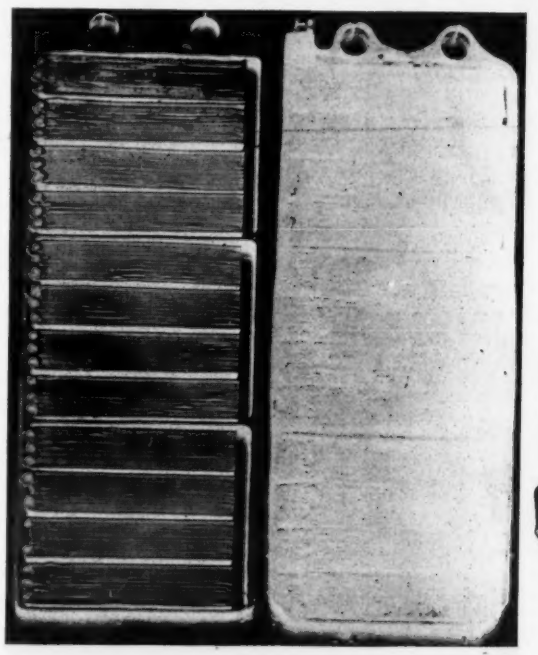


FIG. 4.—NEW PLATE FOR TRAMWAY WORK, AND SAME PLATE AFTER 2160 DISCHARGES.

shape, by an autogen electric welding process (Fig. 3). The plate is then ready for the formation.

Although permitting the production of a plate perfect in every way, this process can compete, it is said, with any other, as to cost. In the manufacture of large surface electrodes it is claimed that no other is so rapid, so simple, and at the same time so cheap. The cost of a plate ready to be formed differs but slightly from that of the lead it contains.

Electrical Compressor Plant of the Chicago and Northwestern Railway Terminal at Chicago.

The air power plant at the terminal station of the Chicago & Northwestern Railway in Chicago is a fine example of the best modern practice in the application of electric power to the compression of air for the many purposes so characteristic of railway yard work.

The plant is located in a small brick building in the rear of the main terminal station, close to the river and adjacent to the extensive passenger yards of the company. This building comprises two rooms, in one of which are the steam boilers for the heating system of the station. In the other section is located the electrical and pneumatic apparatus.

Alternating current is taken from the city mains of the Chicago Edison Company and passed through transformers reducing it to the

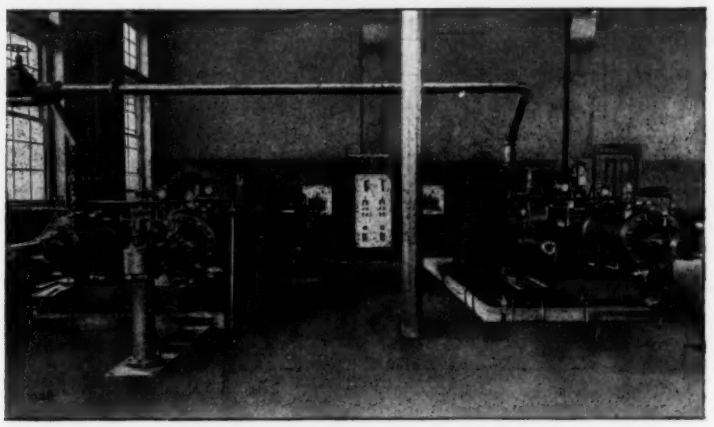


FIG. 1.—VIEW OF INTERIOR OF POWER PLANT.

working voltage. Part of it is used directly on low-voltage alternating circuits. The remainder is passed through rotary converters or motor generators and delivered as direct-current for power purposes.

The air compressor plant is made up of two Ingersoll-Sergeant standard power-driven compressors. They are duplex, two-stage machines, with air cylinders, frames and bearings, mounted on a solid cast-iron bed-plate which encloses the horizontal inter-cooler between the cylinders. Both high and low-pressure cylinders are fitted with the standard Ingersoll-Sergeant piston inlet valve, and regulation is secured by the maker's standard choking controller on the low-pressure intake. This device, acting to throttle the air intake passage, is controlled by receiver pressure and automatically regulates the volume of air compressed and consequently the amount of

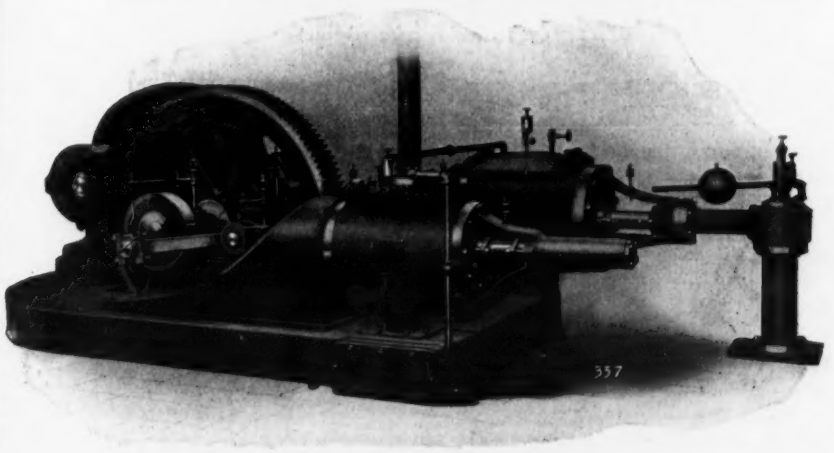


FIG. 2.—AIR COMPRESSOR.

power consumed—to the demand for air from the power system. The compressors run at constant speed, the controller simply varying the effective piston displacement with varying load. The machines have, at their speed of 130 r.p.m., a free air capacity of each unit of 455 cu. ft. per minute. The pressure used in this plant is 70 to 80 lbs. gauge.

The sub-base is extended in each compressor to support the driving motors, which are General Electric direct-current machines, rated

at 80 hp and 510 r.p.m., on 220 volts. A pinion on the motor shaft gears directly with the teeth on the compressor flywheel, which is of standard weight for machines of this capacity. The gears are protected by proper guards. The units run with a remarkable freedom from vibration and noise.

The illustration shows the arrangement of the air plant. The machines are side by side; the switch-board, rheostats, meters, etc., mounted in front of and between them. An intake duct, supplying both compressors, leads under the floor to the open air and rises beside the power house, terminating in a screen cover for the exclusion of dust and cinders from the yards.

The discharge pipes from the two unite in an air main leading to the primary receiver outside the plant. Secondary air receivers are also located at suitable places. The air is used almost entirely in this system of switches and signals, but a small portion is diverted to the boiler room, where it is applied in a small air lift pumping outfit which supplies water to the terminal. The engineers in charge report an excellent performance of this equipment, which has been in severe and continuous service for several years.

Small High-Speed Engines.

It may be stated as broadly true that improvements in small high-speed engines have not kept pace with those in the larger types, possibly because of the lower economy in small units, and because equal inventive and engineering effort has not been concentrated on the problems. The American Blower Company, of Detroit, Mich., seeing the opportunity, put competent designers to the task of producing a line of small engines equal in all respects to the larger machines. These engines embody the following constructional features: They are self-contained, enclosed, self-oiling, and are built for heavy duty, high speeds, high steam pressure and continuous service, without

FIG. 1.—VERTICAL ENGINE.

shutting down, for weeks at a time if need be. These features make this type of engine peculiarly adapted for direct-connected work of any character which demands a thoroughly high-grade engine.

Fig. 1 shows the engine mounted on a sub-base ready for attachment to the electrical generator. It will be seen that the engine has easy curves and graceful lines, giving it a handsome appearance. As has been noted, it is fully enclosed, preventing foreign matter from getting into the working parts, yet the latter are easily accessible by simply turning a milled hand nut and lifting out the enclosing plates.

The most remarkable feature of the engine is the oiling system, to which reference has been made above. Automatic lubrication of engines has been one of the details very slow in development. Such attention as this detail has received had previously been given to only the large horizontal engines, which are less likely to prove annoying through defective lubrication than are the small, high-speed, vertical engines.

The oiling system embodied in this engine is something entirely different from any of the usual methods, and has proven successful far beyond the most sanguine expectations of its designers. Every frictional surface is covered with oil, there being no positive contact between metals, with the effect of practically eliminating wear. The oiling is done by the engine itself, and instead of a drop or two a minute each bearing has a stream of oil. By referring to Fig. 2 the operation can easily be traced. A worm, *K*, on the shaft actuates a geared pump at *A* and through shaft *L*, forcing the oil up through the tube *B* into the small strainer *C*. From *C* it drops into an oil box through the bottom of which four tubes project. In one side of each of these tubes there is a slot, so that when the oil box contains only a small amount of oil, each tube can take only its proper proportion. In case the box is full all the tubes get more oil in proportion to the increased height.

One of these tubes, *F*, and one on the opposite side, not lettered, apply oil to the guides, the oil dropping into a small oil trough, *G*, from which it runs into the bearing through an oil hole. The crosshead pin is supplied by the tube marked *E*; the oil drops into the cup, *H*, and fills the cavity between the bolt and inside of the crosshead pin and the oil grooves. The oil dropping from the crosshead is caught in two pans attached to the inside of the covers. From these oil pans it runs down the inside of the cover, dropping into a cup

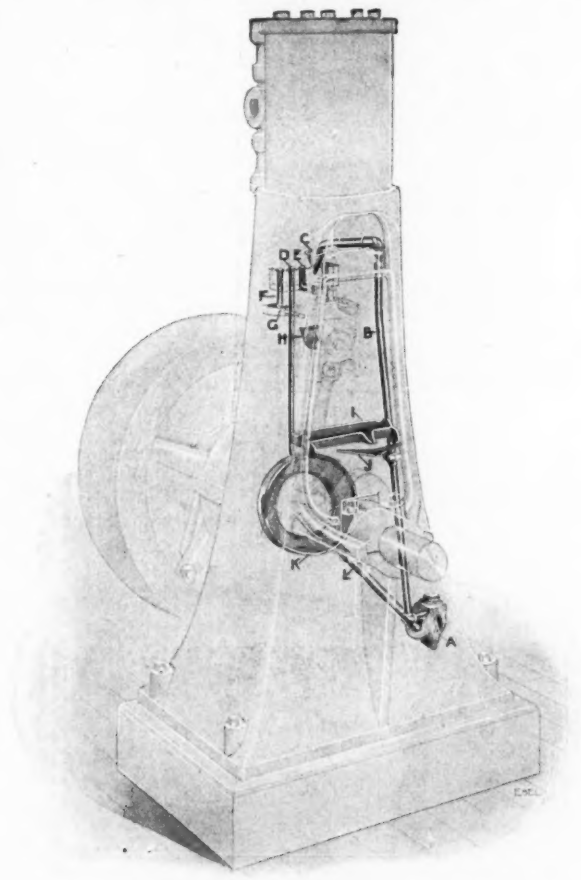


FIG. 2.—PHANTOM PERSPECTIVE OF VERTICAL ENGINE.

in the top of the main bearing cap. Instead of using oil grooves at the top and bottom of the main bearing, in this system the oil is supplied at the sides where the bearing is cut away at the joints. When the strain from the connecting rod is up, the oil is carried to the bottom of the bearing, but when the load is reversed, there are no oil grooves to carry away this oil. The crank pin is oiled through the tube marked *D*. This tube discharges into a crank oil ring inside the eccentric, which in turn discharges into the crank pin oil tube and flows across the crank pin bearing. The crank pin oil ring, in addition to its independent supply, catches the drip from one end of the main bearing. The eccentric is oiled by the drip which it catches from the other end. Not the least difficulty has been experienced in catching the oil thrown off from the eccentric strap, and the splash from the crosshead has been equally easy to take care of, the outside of the engine being absolutely free from oil. A portion of the oil, as it drops back into the bottom of the frame drops upon an oil filter throughly cleaned and purified. The large base gives the oil an excellent opportunity to cool and settle.

It is stated that a certain engine which had been operated from fourteen to sixteen hours per day driving a blower, after the lapse of over four months, really needed no adjustment or fresh lubricant, running almost as noiselessly as at first.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—There was an unusually brisk duplicate order business in wholesale and jobbing circles, and confidence in the future remains unabated. Structural steel and all forms of railway equipment were the prominent features of the iron industry, but quiet conditions prevail. Building material of all kinds reflects the demands of a record year in this respect. Pig iron has been dull and moved lower, but heavy finished products have been in good call. Iron ore shipments exceed those of last year by 42 per cent, and of 1902 by 12 per cent. New contracts for iron and steel are still confined to the few departments that have been overcrowded for months, especially rail mills and the plants producing structural shapes. Transporting lines are now busily engaged in improving facilities, and, while new mileage has not equaled some earlier records, the tonnage required for repairs is enormous and traction demands are considerable. Sensational soaring of quotations for raw materials threatens the stability of the leading textile markets, although consumption is not yet perceptibly diminished by rapidly rising pricelists. Labor is well employed, and the signing of the new tin plate scale removes the only important threatening feature in industrial lines. Railway earnings continue large, the gain in June being 6 per cent, while May net returns exceeded last year by 8.5 per cent, and the fiscal year will show a gain of 7 per cent. Money is easy, helped by fairly good collections, and despite larger movements to the interior, active stock speculation and gold exports. Crop reports were rather irregular, due to too much rain in widely separated sections, but notably in the spring wheat section of the Northwest and in the cotton belt. Business failures for the week ending July 6, *Bradstreet's* says, are far below the normal for this time of the year, being only 127, against 186 the previous week and 172 in the like week of 1904. There were 5,238 failures for the first six months of the calendar year 1905, a decrease of 2 per cent from the same period of 1904. Liabilities total $60,634,667 for the first half of this year, a sum 27 per cent less than was recorded a year ago, and about the same amount as in 1903. The proportion of assets to liabilities in 1905 was 57.4 per cent, as against 55.1 per cent a year ago, and 49 per cent in 1903.

SALES OF IDEAL ENGINES.—The following large list of recent sales of Ideal engines is reported: One 75-hp, Cleveland Worsted Mills, Cleveland, O.; one 100-hp, Birk Bros. Brewing Company, Chicago; one 100-hp, A. Sanders Packing Company, Cincinnati; one 60-hp, T. J. Noblett, Springfield, Ill.; two 110-hp each, American Warming & Ventilating Company, Pittsburg, Pa.; one 150-hp, Connersville Blower Company, Connersville, Ind.; one 45-hp, General Chemical Company, Chicago; one 110-hp, F. W. Horne, Yokohama, Japan; one 100-hp, A. Neilen & Co., Cincinnati; one 160-hp, John Roth Packing Company, Cincinnati; one 160-hp, Mexican-American Supply Company, Mexico; one 100-hp, City of Lamoore, California; one 25-hp, University of California, San Francisco, Cal.; one 225-hp, Hellmers-Bettman Company, Cincinnati; one 150-hp, D. F. Crilly, Chicago; one 118-hp, Wheeling & Lake Erie Railroad Company, Cleveland, O.; one 248-hp, Wheeling & Lake Erie Railroad Company, Cleveland, O.; one 45-hp, Guinle & Co., Rio de Janeiro, Brazil; one 125-hp, State University of North Dakota, University, N. D.; one 150-hp, North Carolina Granite Corporation, Mt. Airy, N. C.; one 160-hp, Cleveland-Cliffs Iron Mining Company, Negaunee, Mich.; one 80-hp, Chicago, Burlington & Quincy Railroad Company, Havelock, Neb.; one 135-hp, Boston & Colorado Smelting Company, Denver, Colo.; one 230-hp, Dering Coal Company, Chicago; two 160-hp each, National Construction & Supply Company, Danville, Ky.; one 47-hp, Acme Plaster & Cement Company, Grand Rapids, Mich.; one 60-hp, Wilkesbarre Gas & Electric Company, Wilkesbarre, Pa.; one 80-hp, Johnson Gin Company, Wills Point, Tex.; one 90-hp, Higbee Electric Light & Power Plant, Higbee, Mo.; one 215-hp, Utah Fuel Company, Sunnyside, Utah; one 135-hp, I. Gutte, Sinaloa, Mexico; one 160-hp, Linn Coal Company, Bicknell, Ind.; two 25-hp each, American Ship Building Company, Cleveland, O.; two 50-hp each, Angelus Hospital Association, Los Angeles, Cal.; one 25-hp, Angelus Hospital Association, Los Angeles, Cal.; one 324-hp, Alhambra Theatre Company, Milwaukee, Wis.; one 125-hp, city of Walker, Minnesota; one 290-hp, Washington Court House Gas & Electric Company, Washington Court House, O.; one 45-hp, Hackensack Water Company, New Milford, N. J.; one 125-hp, W. J. Whetzel, Eureka, Ill.

TENNESSEE RIVER POWER is to be developed by the Chattanooga & Tennessee River Power Company, in which C. E. James and J. C. Guild, of Chattanooga, are interested, Mr. John Bogart, of New York, being the consulting engineer. The plant is to be one of 30,000 to 40,000 hp. Preliminary plans have been prepared and they show that the power plant will be located some 33 miles from the city by river, but only 12 miles in a direct line from Chattanooga. Therefore, there will be 12 miles of transmission circuit. The lock will be 60 ft. wide and the dam 40 ft. high and 1,200 ft. long. The power house will be laid out for 14 units of 3,000 kw each. There will be a transformer house and other buildings. The Tennessee River at the point located passes through a gorge in the Cumberland Mountains and the United States Government has given its assent to the execution of the proposed work there.

STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, Rochester, N. Y., reports having closed contracts for switchboards for the following places: Ardmore, Ind. Ter.; Minneapolis, Minn.; Cleveland, O.; Marion, O.; Delaware, O.; Furley, Kan.; McLain, Kan.; Idana, Kan.; Corson, S. D.; Brandon, S. D.; Star, Idaho; Ridgeway, Ia.; Lodiburg, Ky.; Bristol, Tenn.; Franklin, Pa.; Granville, N. D.; Bowbells, N. B.; Folsendale, Ky.; East Smithfield, Pa.; Elizabeth, N. C.; Washington, N. C.; Mountain Branch, Tenn.; Berwick, Pa.; Fulton, Kan.; Fenton, Ia.; Pontiac, Ill.; Macon, Ill.; Chicago, Ill., and Fulton, Ia.

CURTIS TURBINES IN BOSTON.—One of the leading officials of the Boston Edison Company is quoted as follows in regard to the Curtis turbines there: "In the case of the Curtis turbines used by the Edison Company, they are giving great satisfaction. The fuel economy is apparently no greater than with engines, but they are effecting a total station economy of 20 per cent, as compared with engines under the same conditions. The economy is in labor and attendance. There is no question as to the success of the Curtis turbine, and in my opinion there will be no further engines sold for electric lighting work."

ELECTRIC LIGHT BIDS.—Bids are wanted August 1 by J. G. Hamilton, Mayor of Durant, Miss., for the construction of an electric light plant for which $10,000 bonds are to be issued. Bids will be received August 10 by the Board of Public Service, Bellefontaine, O., for constructing a new electric light plant at a probable cost of $50,000. Bids will probably be received early in August for the construction of water works and an electric light plant at Bolivar, Tenn., for which bonds to the amount of $20,000 have been sold. Granberry Jackson, Nashville, is the engineer.

LARGE ORDER FOR CARS.—The United Railways & Electric Company, of Baltimore, Md., has ordered 200 new cars to cost about $1,000,000, 15 per cent of which will be paid in cash and the remainder will be paid in 5 per cent car trust notes. Ten per cent of the notes will mature each year until all are paid. Each car will be 42 ft. long and will be of the semi-convertible type. The cars are to be delivered by November 1. The system includes all the trolleys in Baltimore, Md., and its suburbs with 379 miles of electric railway.

BIDS FOR NAVAL SUPPLIES.—Bids will be received until July 25 at the Bureau of Supplies and Accounts, Washington, to furnish at the navy yards, etc., Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; New York, N. Y.; League Island, Pa.; Washington, D. C., and Norfolk, Va., electrical supplies, cable, ventilating sets, reconstructing coaling plant, traveling hoist, sheet copper, pressure gauges, etc. Address H. T. B. Harris, Paymaster-General, U. S. N.

NEW ELECTRIC SUPPLY COMPANY.—The Hattiesburg Electric Supply Company has been formed at Hattiesburg, Miss., with an authorized capital of $10,000. It will do a contracting and electrical supply business and will not manufacture any goods. The headquarters are at 204 Main Street, that city. The officers are W. T. Spraney, president; Charles Bynum, vice-president, and John B. Burkett, secretary-treasurer.

APPARATUS FOR CLEVELAND, OHIO.—The Cleveland Electric Railway Company has given orders for new apparatus to go in its Viaduct power station, including a 1,500-kw unit, consisting of an Allis-Chalmers engine and a Westinghouse generator, together with 2,000 hp of Sterling boilers and chain grate stokers. Auxiliary equipment will also be installed.

G. M. GEST, the expert subway contractor of New York and Cincinnati, has a large force of men actively at work in Meridian, Miss., installing the conduit system for the Cumberland Telephone & Telegraph Company at that point. The contract was awarded to him last week.

A RULING ON WATER POWERS.—A ruling that would appear likely to have an important and helpful effect on power transmission enterprises has been made at Washington. According to an order issued by the Secretary of War the water power created by Government dams, built as aids to navigation, is the property of riparian owners. The only limitation to the rights of owners of river frontage in using water power is that they must not interfere with navigation or the improvement of a navigable stream. The limitation not only covers the present improvement of a stream, but also precludes the assessment of damages against the Government on account of future improvements of the river. The occasion for issuing this order was the application of H. P. Dilworth, Charles A. Jamison and H. S. Robinson for the right to use the water power created by dam No. 3 in the Allegheny River. Mr. Dilworth and his associates propose to utilize the water power in an electric plant to be located on the north bank of the river. Before rendering his decision the secretary referred the matter to the legal department, which submitted its opinion upon the legal questions involved, and it is upon this that it was decided to give to Mr. Dilworth and his associates the license to use the water power created at the dam. Before installing his plant Mr. Dilworth will be required to submit his plans to Chief Engineer Mackenzie in order to demonstrate to the War Department that his use of the water will not obstruct navigation. It is held by the War Department that the fact that a stream is made a public highway does not divest private ownership in soil to the middle of the river. As long as a riparian does not interfere with navigation he has license to divert the water from a navigable stream. The fact that the Government builds a dam for the purpose of aiding navigation does not necessarily vest in it the water power rights created by the improvement.

BIDS FOR ELECTRIC CABLE.—Following are the bids opened on July 1 by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the work complete for underground lead-encased, braid-covered incandescent lighting and power cables for the Navy Yard at League Island: National Conduit & Cable Company, $24,586; John A. Roebling's Sons Co., $22,662; Standard Underground Cable Company, $22,965, and American Steel & Wire Company, $24,716.

MORE NIAGARA POWER.—The Electrical Development Company has entered into a contract to supply the Toronto Railway Company and the Toronto Electric Light Company with electrical energy from Niagara Falls at from $35 to $40 each hp wholesale. The present cost of electrical power generated by steam varies from $60 to $100.

METERS IN CANADA.—The Western Electric Manufacturing Company, of Berlin, Ont., was incorporated recently with a capital of $50,000, and intending to make a specialty of electric meters. These instruments are designed specially for central station purposes. Mr. J. H. Messner is actively interested in the enterprise.

GENERATOR WANTED.—The Telephone Improvement Company, Sweetwater, Tenn., D. L. Smith, manager, is in the market for a 50-kw generator, 1,100 volts pressure. Bids will be received until July 31.

Financial Intelligence.

THE WEEK IN WALL STREET.—There was considerable strength in the speculative market, although the activity was mainly professional. Support and manipulation by large interests was apparent in the behavior of the leading stocks, such as Reading and Union Pacific. St. Paul, the Pennsylvania group and Atchison were also strong, but did not take the lead in the further upward movement. United States Steel shares were somewhat irregular, but at the close of the week developed decided strength. The traction group advanced under the lead of Brooklyn Rapid Transit, which was the object of a bullish sentiment, based upon its increasing traffic. The prices of this stock ranged between 70⅞, the lowest, and 73⅜, the highest, the closing quotation being 71½, a net loss of ¼ point. The number of shares sold was 140,900. There was considerable activity in Metropolitan Street Railway, which ranged between 128 and 131, closing at 130, this being a net gain of 2¼ points. Interborough Rapid Transit closed at 200⅜. The electric stocks are all higher and prices were well maintained. Allis-Chalmers common made a net gain of ¼ point, closing at 51⅞; Westinghouse ½, closing at 168, and General Electric 2½, closing at 178¾. Electric Storage Battery is up 4 points, the last quotation being 82, but the telegraph group is down, Western Union ½, and American Telegraph & Telephone ¼, the closing quotations being 93¼ and 139½, respectively. In a general way the curb market followed the lead of the stock exchange list, closing moderately higher than a week ago. Among the most active stocks was Electric Vehicle. Following are the closing quotations of July 11:

NEW YORK

	July 3	July 11		July 3	July 11
Allis-Chalmers Co.	13¼	14	Electric Vehicle pfd.	20	27
Allis-Chalmers Co. pfd.	51¾	52	General Electric	176	176
American Tel. & Cable.	90	90	Hudson River Tel.	..	..
American Tel. & Tel.	139	137	Interborough Rap Tran.	200⅞	200¾
American Dist. Tel.	29	29	Metropolitan St. Ry.	129¾	125⅝
Brooklyn Rapid Transit.	72⅛	69⅛	N. Y. & N. J. Tel.	..	..
Commercial Cable	..	..	Marconi Tel.	..	..
Electric Boat	28	20	Western Union Tel.	93¾	93
Electric Boat pfd.	73	60	Westinghouse com.	167	162
Electric Lead Reduction	..	..	Westinghouse pfd.	..	..
Electric Vehicle	16	20			

BOSTON

	July 3	July 11		July 3	July 11
American Tel. & Tel.	140	139	Western Tel. & Tel. pfd.	101	99¼
Cumberland Telephone.	117⅝	117	Mexican Telephone.	1¼	1¼
Edison Elec. Illum.	*255	*245	New England Telephone.	*139	138½
General Electric.	175	..	Mass. Elec. Ry.	18	*19
Western Tel. & Tel.	18	18	Mass. Elec. Ry. pfd.	*82	63

PHILADELPHIA

	July 3	July 11		July 3	July 11
American Railways.	50¼	50	Phila. Traction.	..	90¾
Elec. Storage Battery.	77	78	Phila. Electric.	8¾	8¾
Elec. Storage Battery pfd.	..	..	Phila. Rapid Trans.	28⅝	28
Elec. Co. of America.	11¾	11¾			

CHICAGO

	July 3	July 11		July 3	July 11
Central Union Tel.	..	..	National Carbon pfd.	117	118
Chicago Edison.	..	150	Metropolitan Elev. com.	24	23⅜
Chicago City Ry.	*190	*190	Union Traction.	..	..
Chicago Tel. Co.	..	..	Union Traction pfd.	..	..
National Carbon.	65	63			

* Asked.

NEW TELEPHONE OPPOSITION.—A new telephone system composed of the Coast Line Telephone Company organized under the laws of South Dakota, capital $10,000,000, and the Coast Line Telephone Company of New Jersey organized under the laws of that State with a capital of $1,000,000, announces that it will begin business immediately. The former company is to be the construction company and the latter the operating company, which will do business in conjunction with other independent companies throughout the State of New Jersey and will co-operate with the State Line Telephone of New York City and the Atlantic Telephone Company of New York City. Application will be made shortly, it is stated, to the authorities in New Jersey for permission to erect poles and string wires. The president of the Coast Line Company is Elias S. Beach, of New York, and S. M. Conger, also of New York, is treasurer. D. A. Reynolds, of Brooklyn, is president of the $1,000,000 company and manager of the Atlantic Telephone Company, of New York, and E. D. Clark, of Jersey City, is secretary. The directors of both companies are as follows: E. A. Rogers, Eugene H. Brock, W. F. Midlige, John J. Toffey, E. V. Haggerty, T. B. Stolet, W. M. Reynolds, E. T. Burroughs, Daniel E. Cleary, George E. Hall, E. D. Clark, Gustav W. Lembeck, Stephen M. Conger, D. A. Reynolds and J. V. Throckmorton.

HARD RUBBER.—The Hard Rubber Company of America has been incorporated under the laws of New York State with a capital of $7,500,000, of which $2,500,000 is 8 per cent cumulative preferred stock and $5,000,000 common stock. It is the nucleus of a consolidation of several hard rubber manufacturers. The output consists of materials made of vulcanized rubber, such as combs, horns and telephone appurtenances. The American Hard Rubber Company, of No. 9 Mercer Street, is one of the principal concerns in the hard rubber business. It has a capital stock of $2,500,000. Edwin W. Belcher, secretary of the company, stated last week that he knew the purposes for which the Hard Rubber Company was formed, but they did not interest the public.

BELL TELEPHONE WEST.—Advices from Boston quote President Fish, of the American Telephone & Telegraph Company, as follows: "There is now a gap of about 170 miles in the Bell lines from coast to coast. However, even if that gap were built over, I do not believe it would be commercially practicable for telephone communications. Improvements must be made before the voice can be carried so far. There is one very long line in constant daily use now. I refer to the line between Omaha and Boston. The Cudahys have houses in both cities and every day they talk from one to the other over our lines. Conversations between Boston and Milwaukee and between Boston and Atlanta, Ga., are quite frequent."

MEXICAN LIGHTING BONDS.—The $6,000,000 bond issue being made by the Mexican Electric Light Company and guaranteed by the Mexican Light & Power Company, has been subscribed for one and a half times. The allotments are as follows: Bank of Montreal, $1,000,000; London Bankers, $1,000,000; directors of the Mexican Light & Power Company, $1,000,000; E. Mackay Edgar Syndicate, $2,000,000; Sun Life Assurance Company, $500,000; Central Canada Loan & Savings Company, $500,000.

NEW HAVEN RAILROAD TROLLEYS.—The New Haven Railroad has taken up the $300,000 stock of the Branford Light & Water Company, controlling the Branford trolley system, with 4 per cent bonds, the stock being bought at $80 per share.

INTERNATIONAL PUMP REPORT.—In his annual report to the International Steam Pump Company, President John W. Dunn says: "The constantly increasing demand for the products of our company has taxed the various manufacturing plants to their utmost capacity, so that they were unable to reduce the amount of unfilled orders on hand. On March 31, 1905, the unfilled orders on the books of the company amounted to $4,510,000. Considerable time and money have been spent in the development of the centrifugal and turbine pumps, gas engines and water meters and satisfactory progress has been made in the manufacture of these special lines. The engineering and manufacturing departments have made many improvements in the quality and efficiency of the standard pumps, and have applied for letters patent covering a great many new designs and devices which have been made to meet novel conditions. The year just closed has marked the transfer of the Henry R. Worthington plant from Brooklyn and Elizabethport to Harrison, N. J. The moving of these works occupied several months and occasioned a very considerable interruption in the business, so that there was a large falling off in the production and shipments. The loss in production, together with the moving and other expenses incidental to the starting of the new plant, have resulted in a decrease in the profits. The new works at Harrison, N. J., are now practically completed and in full operation. This plant was designed with a view to economy and efficiency, and now stands unsurpassed in its adaptability to the manufacture of pumping and hydraulic machinery. The removal of the operations of the Holly Manufacturing Company from the Lockport plant to the enlarged Snow plant at Buffalo was also finally completed early in the fiscal year, and the Lockport plant is now unoccupied and to a large extent dismantled. The machine tools, etc., belonging to the Holly Company, are, however, independently maintained and segregated within the Snow plant at Buffalo. Since the organization of the company in 1899 there has been paid and distributed in redemption of bonds and in interest and dividends on the securities of the company and its constituent companies a total of $7,113,153 and $6,082,976 for new buildings and improvements, making a total of $13,196,130. The benefits of these improvements are expected to be hereafter reflected in the economy and increase of production." The net earnings for the year ended March 31 were $1,332,935, a decrease of $273,682 from the previous year. The interest on the funded debt was $334,499, leaving a balance of $998,436 available for dividends. The dividends paid on the preferred stock were $709,800 and on the common $306,597, showing a deficit for the year of $17,961, as compared with a surplus of $101,644 the previous year, when a larger amount was paid on the common stock. The surplus, after the deduction of last year's deficit, is $2,252,032.

LARGE ELECTRICAL MORTGAGES have been filed at Buffalo, N. Y. One is from the General Electric Transmission Company of Buffalo to the Buffalo Loan, Trust & Safe Deposit Company as trustee, and for $15,000,000. The mortgage deed covers all of the property and franchise of the electric company in all counties of the State. The mortgage is given to secure bonds of the company to the amount stated. These bonds are to run forty years at the rate of 5 per cent per annum, payable half yearly. Another large mortgage was filed for $25,000,000 from the United Message Company of Albany to the Knickerbocker Trust Company of New York as trustee. The trust mortgage covers all the property and franchises of the Message Company in all the States through which its lines may be extended. The company is incorporated for the purpose of maintaining lines of electric telephone and telegraph in the States of New York, Vermont, Connecticut, Massachusetts, Rhode Island, New Hampshire, Maine and the Dominion of Canada. The mortgage is given to secure bonds of the company to the amount stated. These bonds are to run thirty years at the rate of 5 per cent per annum. These mortgages go on file only a little ahead of the time when the mortgage tax act of the last New York Legislature becomes effective. That act went into effect on July 1, and had these two mortgages been held for record until after that date they would have been subject to a tax of one-half of 1 per cent on the aggregate amount ($40,000,000), which would have netted to the State $200,000. This sum the companies saved.

SAN FRANCISCO TROLLEYS.—It is said that the earnings of the United Railroads of San Francisco, all of the stock of which is held by the United Railways Investment Company, are showing such satisfactory progress that banking interests identified with the property express the opinion that the dividend on the preferred stock of the investment company will soon be raised from the 4 per cent to the full 5 per cent rate. Moreover, there has accumulated on the preferred about 5 per cent in back dividends, and the same interests are authority for the statement that consideration will soon be given to the question of paying off this accumulation. Last year the company paid 4 per cent on its preferred stock in addition to spending a considerable amount on improvements, and at the close of the fiscal year on March 1 showed above these expenditures a surplus of $904,710 for the year. Since the beginning of March the gross earnings have increased at the rate of about $28,000 a month, and it is stated that there has been no increase in operating expenses, so that at the present rate the net earnings for the current fiscal year will be larger by about $300,000 than they were last year. If the actual result justifies this estimate the earnings for the year ended March 1, 1906, will be sufficient to pay the full 5 per cent on the preferred for the current year, to distribute the 5 per cent of accumulated dividends, and to leave a substantial sum to add to the surplus. During the past three years the company has spent $3,000,000 in improving its property and has reduced its outstanding indebtedness by $1,300,000.

CUMBERLAND TELEPHONE CO.—The Cumberland Telephone & Telegraph Company has issued the following report of its May earnings:

	1905.	1904.	Increase.
May gross	$373,836	$322,137	$51,699
Expenses	242,669	197,683	44,986
May net	$131,167	$124,454	6,713
Charges	2,805	21,833	972
May surplus	$108,362	$102,621	$5,741
Five months' gross	1,870,308	1,616,702	253,606
Expenses	1,139,380	945,968	193,412
Five months' net			
Charges	106,512	106,212	300
Five months' surplus	$624,416	$564,522	$59,894

TROLLEY FOR MISSOURI VALLEY.—According to advices from Kansas City, Mo., the Missouri Valley Electric Railway Company has been incorporated, with a capital stock of $650,000. Geo. B. Blanchard, a civil engineer, representing Nevins & Co., of New York, is pushing the road. The plan of the company is to construct and operate an electric railway from Kansas City to St. Joseph, with spurs to Leavenworth, Kan., and Atchison, Kan. The length of the main line will be 65 miles. The stockholders, who also comprise the board of directors, are Mr. Blanchard, C. P. Breen, G. B. Tuggle, S. Facker, Wilson McAfee and Howard McAfee, all of Parkville, Mo. The route of the proposed electric railway will follow the river as closely as possible, the idea being to parallel the Burlington tracks.

DIVIDENDS.—The directors of Electric Company of America have declared the regular semi-annual dividend of 3½ per cent, payable July 31. The directors of the United States Rubber Company have declared a regular quarterly dividend of 2 per cent upon the preferred stock from the net earnings of the company and its subsidiary companies for the three months ending June 30, 1905. The dividend is payable August 15. J. G. White & Co., Inc., have declared a quarterly dividend of 1½ per cent on the preferred stock, payable August 1. The El Paso (Tex.) Electric Company, a Stone & Webster property, has declared a semi-annual dividend of $3 per share on its preferred stock.

EARNINGS IN SAN FRANCISCO.—The comparative statement of earnings of the California Gas & Electric Corporation for the months of May, 1904 and 1905, is as follows:

	1904.	1905.	Changes.
Gross earnings	$329,077.41	$447,631.80	$118,554.39
Operating expenses, taxes, ins. and int. sub. cos.	246,434.36	333,727.38	87,293.02
Profit	82,643.05	113,904.42	31,261.37
Corporation bond interest	36,458.34	36,829.17	370.83
Balance	46,184.71	77,075.25	30,890.54
Sinking fund	12,500.00	12,500.00	.....
Net surplus	33,684.71	64,575.25	30,890.54

APRIL TELEPHONE EARNINGS.—Following are the earnings of the United States Telephone Company for April, compared with April, 1904:

	April, '05.	April, '04.
Gross earnings	$38,787.19	$35,709.70
Expenses and taxes	23,802.14	20,013.36
Net earnings	$14,985.05	$15,696.34
Deductions	9,146.70	7,892.87
Surplus for period	$5,838.35	$7,803.47

KINGS COUNTY STOCK.—The stockholders of the Kings County Electric Light & Power Company have voted in favor of the proposition to increase the capital stock from $5,000,000 to $10,000,000. The new stock is to be used in part for extensions.

ELECTRIC VEHICLE.—It is reported that a readjustment of the securities of the Electric Vehicle Company is to take place.

General News of the Week

The Telephone.

NOME, ALASKA.—The Chicago Telephone Supply Company has sent R. L. Goudy to Nome, Alaska, to install a central energy telephone system of several hundred telephones.

SAN FRANCISCO, CAL.—J. S. Torrance and T. W. Torrance, who are interested in the Home Telephone Company, recently arrived in this city on business connected with the new system projected here.

HARTFORD, CONN.—The Southern New England Telephone Company has increased its capital stock to $10,000,000.

COLLINSVILLE, CONN.—The Farmington Valley Telephone Company has raised its capital from $27,000 to $54,000.

LOS ANGELES, CAL.—The Home Telephone & Telegraph Company has created the offices of assistant general manager and second assistant general manager. The first has been filled by the appointment of C. L. Swain, formerly assistant superintendent of the Southern Pacific, and the second by C. C. Craig, who has been in the employ of the Home Telephone Company since it began business. The new offices were made necessary by the company's increased business. The business of the company has grown to such an extent that official action has been taken looking toward doubling its capitalization and its bonded indebtedness. The company is said to have 19,000 subscribers in Los Angeles, with 2000 waiting orders.

BOISE, IDAHO.—The Idaho Independent Telephone Company will build a modern 3-story building for telephone purposes, at a cost of about $35,000.

CHICAGO, ILL.—The Chicago Telephone Company's gain for June was 2212 subscribers, making a total of 130,316.

PATRIOT, ILL.—The Farmers' Mutual Telephone Company has been incorporated, with a capital of $25,000. Incorporated by James Mead and F. H. Groeve.

LIVINGSTON, ILL.—At the annual meeting of the Reddick Mutual Telephone Company it was voted to increase the capital of the company from $5000 to $10,000.

ALBION, ILL.—The Board of Directors of the Edwards County Mutual Telephone Company has organized by electing Charles Clark, president; O. A. Bunting, secretary, and Moses Gumbrell, treasurer. The company incorporated with a capital stock of $4000.

ELDORA, ILL.—The Hardin County telephone system, formerly known as the Cedar Valley, has passed into the possession of the Iowa Telephone Company, of Des Moines. The sale includes the Eldora, Steamboat Rock, Ackley and other exchanges in the smaller towns of the county other than the Mutual Company exchanges in Eldora and Iowa Falls.

SYRACUSE, IND.—The Syracuse Home Telephone Company has decided to sell its plant.

FRANKFORT, IND.—The local independent telephone company has been sold to the Bell Company for $125,000.

FLORA, IND.—The Central Union Telephone Company is making a strong fight to invade the local field and from this point secure every co-operative telephone plant in Carroll County.

CONVERSE, IND.—The Central Union Telephone Company is installing a new switchboard and making other changes and improvements in the plant recently acquired from Amboy Home Telephone Company.

KOKOMO, IND.—There is a fight between the New Long Distance Telephone Company and the Bell Telephone Company for control of the plant of the Citizens' Telephone Company of the city. The Council has introduced an ordinance, at the instance of the Citizens' Company, repealing the clause in its franchise which prohibits it from entering into a contract with the Bell company for long-distance connections.

RICHMOND, IND.—The Central Union Telephone Company is now ready to begin the work of placing its wires underground and is urging the City Council to permit it to construct a conduit system. The committee has been instructed to prepare the ordinance. If the permission for the construction of an exclusive underground system is not granted the Central Union Company will proceed at once to spend $7000 in improving its pole line system. The company complains of the trouble with its lines on account of the close proximity of its wires to the high-tension wires and is anxious to remedy it.

PORTLAND, IND.—It is believed here that the Bell telephone interests have entered upon a systematic campaign against the independents in Jay County. It is rumored that the slight lead gained some months ago in the purchase of a controlling interest of the United Telephone Company has been followed by the purchase of the independent exchanges at Dunkirk and Redkey. Attempts were also made to secure independent exchanges at Bryant and Salamonia, but the owners refused to sell at any price, and the latter are preparing to cover the county with a complete toll line system of their own.

GREENFIELD, IND.—The mayor and city council have locked horns with the Morrison Telephone Company over a peculiar question of right and the forfeiture of the company's franchise is threatened in consequence. A false alarm of fire was recently sent in over the company's wire and during the run one of the department's horses was permanently injured. When the fire chief requested the number of the telephone responsible for the run, the operator declined to give it, saying it was against the rules of the company. A meeting of the city council was called and Manager Earley was asked to explain, the mayor taking the view that the telephone is a part of the fire department system. Mr. Earley would do nothing more than promise to investigate, and up to the present has declined to make any report to the authorities as to the responsibility of the false alarm.

VENTURA, IA.—The citizens have organized a telephone company, with Frank Wheeler as president, and Walter Leonard, secretary.

ELDORA, IA.—The Hardin County telephone system, formerly known as the Cedar Valley, has passed into the possession of the Iowa Telephone Company.

DES MOINES, IA.—The Mutual Telephone Company has announced an increase of $6 per year in its charge for residence telephones.

BLOOMFIELD, IA.—John M. Lain, M. D. Sprout, O. S. Reed and Henry Utt have purchased the Steckel telephone line, running from Bloomfield to the Lain and Sprout farms at Shunem. The purchase covers the entire Shunem line and the wires will be connected with the Farmers' Mutual switchboard at this place.

TABOR, IA.—The City Telephone Company has held a special meeting of stockholders and officers to arrange for the dissolution of the company and its reorganization into two companies, one for Fremont and one for Mills County. The former will have its headquarters here and continue under the old name of "City Telephone Company." The Mills County company will have its principal offices at Malvern.

OSBORNE, KAN.—The Bloomington Mutual Telephone Company has been organized with a capital of $3000.

ATCHISON, KAN.—The directors of the Atchison Telephone Company have authorized the increase of the bonded indebtedness of the company from $75,000 to $150,000. It is the intention to construct a number of country lines to connect with the smaller towns and also to connect the farms along the way.

IOLA, KAN.—The Missouri & Kansas Telephone Company has purchased the local telephone system from Arnet & Hobart, and will begin at once to rebuild the plant and make a thoroughly modern system. The central emergency system will be put in and many miles of cable installed. In addition a two-story brick building will be put up especially equipped for the central station. In addition to the local plant, the Gas City system has been purchased by the long-distance lines between the two towns.

PADUCAH, KY.—The People's Independent Telephone Company has been absorbed by the Paducah Home Telephone Company, a new concern recently organized, which is virtually the Louisville Home Telephone Company. The new company is capitalized at $250,000.

BATON ROUGE, LA.—The Louisiana Railroad Commission has given notice to the Cumberland Telephone & Telegraph Company that at the next session it will take up for the purpose of adopting a rule providing that deductions shall be made from telephone charges whenever telephones are out of use for a period longer than 24 hours in a city or 48 hours in the country except for causes beyond the control of the company, and in such cases rules will be fixed for deduction to be made after certain delays.

BALTIMORE, MD.—The Highways Commission has granted permission to the Chesapeake & Potomac Telephone Company to build a line from White Hall to Bluemont, and from Herford to Mount Carmel.

WINDOM, MINN.—The Windom Mutual Telephone Company has just made long-distance connections with Dundee, Fulda and Kimbrae.

EXCELSIOR, MINN.—The farmers on the upper lake have formed a new telephone company, to be known as the Lakeside Rural Telephone Company. A line will be built which will complete direct communication with the Twin City.

PARIS, MO.—The Paris Telephone Exchange has been sold to the Buffum Telephone Company.

CENTERVILLE, MO.—The Centerville Telephone Company, of Centerville, has been incorporated for $2,000. The incorporators are J. J. Jamison, W. S. Carter, Z. C. Smith, C. M. Buford, Wm. H. George, Wm. Rayfield and others.

ST. LOUIS, MO.—The City Council has made arrangements with the Kinloch Telephone Company to place telephones in various parts of the city for the exclusive use of the police and fire department.

CARTHAGE, MO.—The Home Telephone Company has filed a certificate showing that the company has increased its capital stock from $200,000 to $750,000. The company expects to invest the extra capital in improvements and extensions. It has voted $100,000 of the extra capital to be used at once.

LOUNSBERRY, MONT.—Articles of incorporation have been filed by the Lounsberry-Bradley Telephone Company, with a capital of $2,600. Incorporated by E. T. Megna and F. J. Faehn.

AURORA, NEB.—The Hamilton County Telephone Association has purchased the interests of the Bell Telephone Company in this city.

OMAHA, NEB.—The Nebraska Telephone Company has purchased a lot in South Omaha on which a brick block will soon be built. It is stated that the company proposes to expend from $75,000 to $100,000 in the way of improvements in its system in South Omaha this year.

TRENTON, N. J.—The Coast Line Telephone Company, capital $1,000,000, was incorporated here June 28. The incorporators are D. A. Reynolds and E. H. Brock, of New York, and E. P. Clark, of Jersey City.

FREEHOLD, N. J.—The franchises and property of the Freehold Telephone & Telegraph Company, which suspended operations last fall, have been sold at public auction by George H. Atkinson, trustee. They were purchased by George W. Eggert, of Perth Amboy, for $1550. Mr. Atkinson also sold the property of the Red Bank Telephone Company to Henry C. McLean, of Red Bank, for $2550.

ALBANY, N. Y.—The Cobleskill Telephone Company certified that it has increased its capital stock from $6000 to $15,000.

JAMESTOWN, N. Y.—Fire in Panama, Chautauqua County, on July 7, destroyed every business place in the village, including the exchanges of the Bell and Independent telephone companies.

SYRACUSE, N. Y.—The Independent Telephone Company has been incorporated with a capital stock of $1,000,000. The directors are Jacob Ames, Baldwinsville; A. K. Hiscock, C. M. Warner, Syracuse, and C. F. Lamb, Rochester.

BUFFALO, N. Y.—The Consolidated Telephone Company, which recently purchased the stock of the Frontier Telephone Company, at a meeting of its directors voted to increase its directorate and these men were elected: John Markle, Wilkesbarre; J. Sloat Fassett, Elmira; E. Frank Brewster, Rochester; George W. Thayer, Rochester; V. Moreau Smith, Rochester, and Charles W. Goodyear, Buffalo.

HUNTER, N. D.—The Hunter Telephone Company's stock has been increased from $5,000 to $15,000.

CINCINNATI, OHIO.—A new exchange has been opened by the Cincinnati & Suburban Bell Telephone Company at 2422 Gilbert Ave.

MORGANSVILLE, OHIO.—The Morgansvillle Telephone Company has been incorporated, with a capital stock of $50,000. The incorporators are Jackson Jones, W. J. Warne, J. C. Glass.

CLEVELAND, OHIO.—During the last month the Central Union Telephone Company has opened new exchanges as follows: Centerville, O.; Gilman, Ill.; Milan, Ill.; Onarga, Ill.; Pitchin, O.; Spring Valley, O.; West La Fayette, O.

HAMILTON, OHIO.—The Cincinnati & Suburban Bell Telephone Company, which controls the Hamilton Bell Telephone Company, has purchased a site at Hamilton on which will be erected a fine exchange. The building will cost $50,000 and the switchboard $30,000. The capacity of the board will be for 6000 lines.

COLUMBUS, OHIO.—The Central Union Telephone Company has just issued a statement showing the number of Bell instruments in use in Ohio May 1, as compared with January 1. On Jan. 1, 1905, there were 130,011 Bell telephones in Ohio. May 1, there were 142,237, an increase of 12,226. This gain is at the rate of 40,000 a year.

NEW LEXINGTON, OHIO.—The Perry County Telephone Company, recently organized for the purpose of taking over the properties of the Sunday Creek Valley Telephone Company and the Central Union or Bell Company, has elected the following officers: E. S. Martin, president; Wm. A. Allen, vice-president; T. M. Potter, secretary, and C. B. Enlow, treasurer.

CINCINNATI, OHIO.—The Cincinnati & Suburban Telephone Company has made a substantial reduction in the telephone rates for all classes of unlimited service. There will be no five-year contracts hereafter. All contracts will be for one year and the rate will be on the same basis that it was for a five-year contract. The unlimited business service is reduced from $125 to $100; residence telephones, individual lines, from $72 to $60; two-party lines, from $60 to $48; three-party lines, from $48 to $36. four-party lines, from $36 to $30.

OKLAHOMA CITY, OKLA.—The Fort Cobb Telephone Company has been organized with a capital of $2,500. The incorporators are R. A. Woodbridge, John W. Wright and others, of Oklahoma City.

OKLAHOMA CITY, OKLA.—The Lone Wolf Telephone Company, with a capital of $5000, has been organized by D. L. Stromquist, of Mullhall, and R. A. Woolridge, of Oklahoma City.

BENTON, PA.—The Benton Rural Telephone Company has been incorporated. Capital, $5000.

SALADASBURG, PA.—The Saladasburg & Linden Telephone Company has been formed with a capital of $5000.

NASHVILLE, TENN.—The Cumberland Telephone Co. will erect an $8000 branch exchange in this city.

NASHVILLE, TENN.—Ernest T. Mitchell and C. A. Thatcher are the latest applicants for a Nashville telephone franchise, with conduits. Messrs. Mitchell and Thatcher are said to represent the Automatic Telephone Company, of Chicago.

LERO, VA.—The North Frederick Telephone Company has been chartered; capital, $1,000. Incorporated by S. E. Brown, president; E. Jackson, secretary.

BELOIT, WIS.—The Beloit Telephone Company has been organized with a capital of $20,000.

BALDWIN, WIS.—The Baldwin Telephone Exchange, of Baldwin, has amended its charter, increasing its capital to $15,000.

GREEN BAY, WIS.—The stockholders of the Manitowoc & Western Telephone Company have decided to extend the company's line from Greenleaf to Green Bay. The company is capitalized at $12,000.

MILWAUKEE, WIS.—The Chicago & St. Paul Telegraph Company has been incorporated to build and operate telegraph and telephone lines from Hudson to Milwaukee and other cities in this State; between St. Paul and Stillwater, Minn., and other places in that State, and to Chicago and other places in the State of Illinois. The capital stock is $100,000. The incorporators are: A. G. Zimmerman, County Judge of Dane County, and Attorneys Rufus B. Smith and Alfred T. Rogers.

APPLETON, WIS.—Representatives of the Fox River Valley Telephone Company, of Appleton, and the Valley Telephone & Telegraph Company, of Green Bay, have effected a consolidation of the two companies. The former company operates an exchange of 1500 telephones at Appleton, with toll lines and local exchanges at 45 other points in the valley and eastern Wisconsin. The Green Bay Company is building exchanges at Green Bay and Depere, which will be in operation by Aug. 1 and work will begin at once on a line from Kaukauna to Depere, which will connect its lines with those of the Fox River Valley Company.

Electric Light and Power.

ARGENTA, ARK.—The citizens have petitioned Council to establish water works and an electric light plant.

TEXARKANA, ARK. — The Texarkana Gas & Electric Light Co. has changed its name to the Texarkana Gas & Electric Co. and reduced its capital stock from $200,000 to $100,000.

CHINO, CAL.—The Chino Land & Water Company will construct an electric light plant for Chino.

EUREKA, CAL.—Bids are wanted until July 17 for the purchase of an electric power franchise. J. S. Brown is chairman of the committee.

SANTA BARBARA, CAL.—The stockholders of the Merchants' Electric Company have decided to proceed at once with the construction of an independent plant.

LOS ANGELES, CAL.—The Ciy Council has been asked by the Municipal League to consider the matter of a municipal lighting plant. The present cost of lighting is about $133,000 annually.

SAN FRANCISCO, CAL.—The Sierra Nevada Water & Power Company has been incorporated, with a capital of $5,000,000, by G. B. Crittenden, W. L. Stowell, R. M. Kreiser, and others.

LOS ANGELES.—A new city ordinance has gone into effect, providing that electric energy supplied by the lighting company shall not vary more than 3 per cent. from the standard; also for tests of electric meters to be made by the city electrician.

LOS ANGELES, CAL.—The City Council has passed a new ordinance under which corporations will be obliged to submit a complete financial statement annually to the city after Jan. 1, 1906. The Council is empowered to fix a price for the service provided.

ANAHEIM, CAL.—The City Trustees of Anaheim are considering the advisability of leasing the city electric light plant to the Edison Electric Company. This company claims that it can operate the plant cheaper than the city. It offers to pay the city 12 per cent. of the gross receipts of the lighting service, with an agreement to give the city the right to terminate the contract in a year.

LOS ANGELES, CAL.—Various interested companies have been holding meetings for the purpose of devising plans whereby telegraph, telephone, electric lighting and trolley poles shall be removed throughout the city and consolidated systems erected in their place down alleys and back streets.

LOS ANGELES, CAL.—Broadway, in this city, which is over a mile long, is one of the best lighted thoroughfares in the world. Electroliers stand on either side of the street, having been erected at an expense of about $15,000 by abutting property owners. These poles display 1600 ornamental incandscent lights, effectively softened by milk-white globes. This system, recently installed, is lighted by the municipality at a monthly cost approximating $900.

SAN FRANCISCO, CAL.—The Reno Power, Light & Water Co.'s plant at Reno, Nev., was shut down for ten days while the armature of the main generator was being rewound. The company's circuits were temporarily supplied from the Truckee River General Electric Company's plant at Floriston. The burn-out was caused by a cat, which climbed a pole on the high-tension line in Reno and produced a short circuit.

WASHINGTON, D. C.—A report made by Gen. George H. Harries, as vice-president of the Potomac Electric Power Company, is to the effect that all overhead wires on Seventh St. have been removed. Gen. Harries also reports that during the past fiscal year his company has taken down wires and put them underground to an aggregate length of 19,560 ft.

WILMINGTON, DEL.—The question of constructing a municipal electric lighting plant, in conjunction with the pumping station, for street and public lighting only, is under discussion here. Theo. A. Leisen is chief engineer of the water department.

CALHOUN, GA.—Geo. C. Chambers, of Calhoun, will construct an electric light plant to cost from $3,500 to $4,000, and operate it with water power.

OTTAWA, ILL.—The Ottawa Power Company has been incorporated with a capital of $5000. The incorporators are: Jas. A. Seddon, Chas. W. Hadley, and others.

QUINCY, ILL.—At the annual meeting of the Quincy Gas & Electric Company it was voted to increase the capital of the company from $600,000 to $2,000,000. K. I. Lynn is president, and M. G. Borgman, treasurer.

CHICAGO, ILL.—Plans have been filed by the Commonwealth Electric Company for a 2-story power house, to be constructed at 22d and Fisk Sts., to cost $50,000; also for a one and two-story brick power house, to cost $35,000.

CHICAGO, ILL.—The Chicago & Suburban Water & Light Co. has accepted the offer suggested by Mayor Dunne that the city purchase its plant in Austin for $250,000, and an ordinance for the purchase of the system at this price has been introduced in the council.

MURPHYSBORO, ILL.—The Carbondale Water, Light & Power Company has been placed in the hands of Attorney Otis Glenn as receiver, on application of the American Trust and Savings Bank of Chicago, which holds a trust deed to all the property, as trustee to secure payment of bonds and interest.

COLUMBUS, IND.—The Columbus Street Railway & Light Company is to build a new power house and steam-heating plant.

TELL CITY, IND.—Bids will be received by Frank Hinkle, City Clerk, for new machinery to be installed at the electric light plant.

EVANSVILLE, IND.—The Evansville Gas & Electric Light Company will erect a plant in this city to supply electric power to the various traction lines now operating here.

INDIANAPOLIS, IND.—The Cheney Electrical Co. has secured the contract for the electric wiring and fitting for the new State Industrial School for Girls, to be located on Crawfordsville Pike, for $9,178.

WATERLOO, IND.—The Waterloo Electric Light Company has experienced considerable annoyance from the burning out of transformers by lightning. The repairs have to be made in Fort Wayne, often causing considerable delay. The company will solicit bids for putting up lightning arresters.

WASHINGTON, IA.—The Iowa Gas & Electric Company has been incorporated, with a capital of $100,000.

NEWTON, IA.—The Council will purchase a storage battery equipment for the electric light plant, at a cost of $8000.

WATERVILLE, ME.—The Fort Halifax Power Company, of Waterville, has voted to reduce the amount of its capital stock from $250,000 to $100,000.

COTTONWOOD FALLS, KAN.—The Smith Light & Power Company, of Bolivar, Mo., has received a franchise from this town and is installing a plant here.

CHETOPA, KAN.—Burns & McDonnell, Kansas City, Mo., are preparing plans and specifications for water works and an electric light plant, to cost about $30,000.

ABBEVILLE, LA.—Bonds to the amount of $40,000 have been sold, to be used for water works, sewerage and electric lights.

PORTLAND, ME.—The Green River Power & Development Company has been organized at Portland with $5,000,000 capital stock, of which $800 is paid in. The officers are: President, H. P. Sweetser, of Portland; treasurer, L. L. Hight, of Portland.

HOLYOKE, MASS.—Contracts for the buildings, water wheels and electrical and steam apparatus for the Holyoke Water Power Co. have not yet been let.

ANN ARBOR, MICH.—The stock of the Washtenaw Light & Power Company is reported to have been purchased by Alex Dow, of Detroit; R. W. Hemphill, Jr., of Ypsilanti, and others. The directors are reported to have decided to develop the Huron River power, manufacture gas and extend the power service in Ann Arbor and Ypsilanti.

LEWISTON, MONT. — John L. Bright, of the Citizens' Electric Company, who recently purchased the stock of the Livingston Electric Light Company, has perfected all plans for installing a new plant throughout.

MISSOULA, MONT.—Owing to the increased demand upon the light and water company for lighting facilities in this city, additions to the power plant at Bonner have been decided upon, which will cost when completed in the neighborhood of $30,000. A Westinghouse-Parsons turbine will be installed It will be the first steam turbine to be placed in the State of Montana.

WEBB CITY, MO.—J. C. Harrison and Robt. Holt, of Carthage, have petitioned for a franchise and contract to light Webb City.

CAMDEN, MO.—The Camden Water, Light & Power Company of Missouri has filed a certificate designating Daniel Davies, of Camden, as agent for Arkansas, and that $30,000 of its $50,000 capital is in use in Arkansas.

ST. LOUIS, MO.—The West Cabanne Improvement Co. has filed an application for articles of incorporation for the purpose of furnishing light, heat and power in the city of St. Louis and St. Louis County. The capital is to be $25,000, half of which is paid. Thomas C. Henning owns a majority of the stock. Among the other stockholders are W. W. Colver, Arthur E. Ewing, Montague Punch, William Yule, Jesse P. Baker, George Kingsland, W. F. Funsten and Charles E. Ware.

TECUMSEH, NEB.—An election will probably soon be held to vote on issuing $9500 for a new electric light plant. P. H. Hopkins is Mayor.

PORTSMOUTH, N. H.—The Rockingham Light & Power Company is putting in a new large fan to be used for induced draft in the boilers and chimney at the power plant at Portsmouth, N. H. The company has also contracted with the Hodge Boiler Works, of East Boston, for the erection of a large tank to hold 135,000 gallons of feed water for the boilers. This will be taken directly from Beverly Springs.

NEWARK, N. J.—The Licking Light & Power Company, of Newark, has ben incorporated. The concern has been reorganized by Melville Gillett, of Newark, and Congressman Beman J. Dawes, of Marietta. The capital is $300,000, one third of which is preferred stock. In addition to Gillett, the incorporators are Henry G. Bohl, John P. Maynard, W. G. Bathalow and J. W. Danford.

PAUL SMITH'S, N. Y.—The Paul Smith's Electric Light & Power Company has been incorporated with a capital stock of $100,000. The directors are Paul Smith, Phelps Smith and Paul Smith, Jr.

NEWBURGH, N. Y.—It is reported that the Cornwall Electric Light & Power Company will sell out to the Newburgh Electric Light, Heat & Power Company. Capt. Thomas Taft is at the head of the Cornwall company.

ALMA, N. C.—The Carolina Electric Company has moved its plant from Maxton to Alma, where fuel is cheaper.

ALBEMARLE, N. C.—The Albemarle Light & Water Company is in the market for an outfit for a small electric light plant. R. Smith is secretary.

SPENCER, N. C.—The citizens have voted to issue $15,000 bonds to be used for water works, sewerage, electric lights, street improvements and graded schools.

FAYETTEVILLE, N. C.—Bids are wanted until July 20 for additional improvements to the municipal electric light plant, at a probable outlay of $10,000. W. Thomas Jones is the superintendent. The Finance Committee of the Board of Aldermen has been instructed to sell $30,000 of 5 per cent., 30-year electric light bonds.

FAYETTEVILLE, N. C.—The Cape Fear Power Company, at Buckhorn Shoals, near Fayetteville, will develop about 4,000 horse-power and have the same ready for transmission about August 1.

ASHEVILLE, N. C.—A meeting of the water and light commission will be held to consider the issuing of water bonds, and also $40,000 electric light bonds for constructing a plant on Swannanoa River.

CHARLOTTE, N. C.—The Southern Power Company has been organized in New York City with a capital stock of $7,500,000, to develop large water powers on the Catawba River in North Carolina and upper South Carolina. The new company is organized under the laws of New Jersey, and Dr. W. Gil Wylie, of New York, is president; B. N. Duke, of Durham, N. C., first vice-president; W. S. Lee, of Charlotte, second vice-president and chief engineer. The offices of the company will be in Charlotte, N. C. The first power to be developed will be at the Great Falls of the Catawba, where a plant will be erected costing about $1,500,000.

TOLEDO, OHIO.—The City Council has authorized Frank Consaul, city engineer, to prepare estimates for an electric light plant.

BELLEVUE, OHIO.—The Mutual Light & Power Company has been incorporation by R. F. Bell, C. W. Bell, W. H. Bell, Peter Brady and E. C. Crocker. Capital, $50,000.

CANTON, OHIO.—The Merchants' Heat, Light & Power Company has been formed. Incorporators: T. F. Turner, W. L. Stolzenbach, John Kommel, B. T. Steiner, Charles T. Austin, W. S. Shertzger. Capital stock, $500,000.

KENTON, OHIO.—The Kerlin Brothers Company, Toledo, Ohio, has purchased the plant of the Kenton Gas & Electric Light Company, and is securing estimates on new electrical and steam equipment to cost $50,000, for the improvement and extension of the system.

COLUMBUS, OHIO.—The municipal light plant has commenced to furnish electric current for the lighting of nearly the whole city. Under the new plan, there will be only one stretch in the city not lighted by the municipal plant, this being the distance between the court house and the Union Station in High St., where the arches are still lighted by the merger company. It is the intention to permit the company to continue the lighting of the arches under yearly contract. A number of additional lights will be added to the municipal service, the plan contemplating eventually the use of 1950 lamps.

WAMPUM, PA.—An election will be held in August to vote on issuing $12,000 bonds for a gravity water system, and to equip the borough with electric light, power to be obtained from the Ellwood Power Co., of Elwood, 5 miles distant.

GREENCASTLE, PA.—The Borough Council has passed the ordinance granting Isaac I. Wingert, of Chambersburg, representing the Greencastle Light, Heat, Fuel & Power Co., a franchise to establish in Greencastle an electric light and gas plant.

LANSDALE, PA.—Contracts for rebuilding the electric light plant have been awarded as follows: To the Elm City Iron Works, Erie, Pa., for the steam equipment including one boiler and two engines and all connections; and the Fort Wayne Electric Works, Fort Wayne, Ind., for two dynamos of 125-kw. capacity and switchboard with all equipment and 60 enclosed arc lamps.

CENTRAL FALLS, R. I.—The matter of constructing a municipal electric light plant is to be decided in joint special convention. The probable cost of the plant is $75,000.

GREENVILLE, S. C.—The Council has granted a franchise to the Saluda River Power Co. to string wires and supply electricity in this city for a period of 40 years.

CLARKSVILLE, TENN.—The Consumers Electric Light, Power, Heating & Refrigerating Company has been formed here to construct an electric light plant.

CHATTANOOGA, TENN.—Plans are about completed for the proposed dam and power plant for the Chattanooga-Tennessee River Power Company, to be constructed under the supervision of Maj. Henry C. Newcomer. Work will begin about Sept. 1.

KNOXVILLE, TENN. — In regard to the proposed power plant of the Knoxville Power Co. on Tennessee River, Engineer Jas. B. Cahoon, of New York, states that it will probably not be financed before fall and nothing will be done until then.

LLANO, TEX.—Engineer John W. Maxcy, of Houston, is reported to be investigating the feasibility of constructing a power plant on Llano River, also the construction of an irrigation system.

BRISTOL, VT.—The Lake Dunmore Power & Traction Company, which recently absorbed the Bristol Electric Company, is constructing a steam auxiliary plant and has completed surveys for a large dam to be built about a mile above its present plant on New Haven River. H. W. McIntosh, of Burlington, is the engineer.

RICHMOND, VA.—The Water Commission has adopted the report of the subcommittee endorsing the proposed new electric light plant at the old pump house, to cost, for building, $12,000; for electric pumps, motors, transformers, switchboard, transmission line, etc., $25,000, and for a main between pump house and new reservoir, $52,000.

PORT TOWNSEND, WASH.—John Seiderbaum has petitioned Council for a franchise for a gas, electric light and heating plant.

TACOMA, WASH.—The Fire and Water Committee has recommended the passage of a resolution, authorizing the City Clerk to call for bids, to be submitted by Oct. 1, for the construction of a water-power generating plant of not less than 5000 horse-power and not more than 10,000 horse-power.

NAPANEE, ONT.—The citizens have voted to issue $35,000 bonds for a municipal electric light plant.

ROSSLAND, B. C.—In regard to the development of Upper Bonnington Falls, Ross & Holgate, of Montreal, Que., are the hydraulic engineers in charge. S. A. Campbell, of Rossland, is supervising the electric installation. The contracts for apparatus have been awarded as follows: To the I. P. Morris Company, of Philadelphia, Pa., for water wheels; to the Canadian General Electric Company, of Toronto, for generators and switchboard apparatus, and to the Westinghouse Electric & Manufacturing Company, of Pittsburg, Pa. for the transformers.

The Electric Railway.

BRANFORD, CONN.—The New York, New Haven & Hartford Railroad has acquired the Branford Lighting & Power Company. This company controls the Branford Railway Company, which lines are used from East Haven to Branford by the Consolidated Railway Company. The Branford Lighting & Power Company is capitalized at $600,000, of which only $300,000 has been issued. It has authority to furnish lighting and power, to construct water works and railways. The officers of the company are: President, A. E. Hammer; W. G. Bushnell, of New Haven, vice-president; A. M. Young, A. O. Shepardson, of Waterbury; F. F. Brewster, of New Haven, and F. H. Golding, of Branford.

TAYLORSVILLE, ILL.—Articles of incorporation have been issued to the United States Construction Company to construct an electric railway from Decatur to Quincy. The incorporators and first board of directors are George M. Skelley, John E. Melick, James S. Sutton, Charles F. Bisch and Cyrus Farrow.

PORTLAND, IND.—The City Council has granted a franchise to the Fort Wayne & Springfield Traction Company, to extend its line from Decatur to Portland.

SHELBYVILLE, IND.—The City Council has granted a franchise to Charles L. Henry, president of the Indianapolis & Cincinnati Traction Company, to continue his line through this city to Greensburg.

NORTH MANCHESTER, IND.—The City Council has granted a franchise to the Indiana Northern Traction Company, the choice of three routes into the city being given. The company proposes to build from Wabash to North Manchester, as an extension of its line now in operation between Marion and Wabash.

LAPORTE, IND.—The South Bend Western Railway Company and the Laporte & Michigan City Traction Company, capitalized at $500,000 and $400,000 respectively, have been merged into the South Bend, Laporte & Michigan City Traction Company, with a capital stock of $1,000,000. The South Bend Western Company is now building an interurban line between Laporte and South Bend. The intention is to extend the line northwest to Chicago and east to Cleveland, Ohio.

COALGATE, I. T.—Mr. C. S. Young, representing Eastern capital, has asked the city for a franchise for the construction of an electric railway, to run from here to Atoka, via Lehigh, Phillips and Midway.

SOUTH McALESTER, I. T.—The Choctaw Railway & Light Company was chartered June 27 with a capital stock of $500,000. It will take over the Indian Territory Traction Company's properties, thus preventing the appointment of a receiver asked for by the minority stockholders some time ago. The new concern is controlled by Chicago capital.

BANGOR, ME.—Negotiations are now pending between the bondholders, who recently acquired control of the Penobscot Central Railroad, a 25-mile trolley line from Bangor to Charleston, and the Bangor Railway & Electric Company, which will probably result in the sale of the road within a few days to the Bangor corporation, which owns all the other electric roads in this city and vicinity. The Penobscot Central cost $450,000. It is said the property can now be secured for $75,000.

BALTIMORE, MD.—The contract for the erection of the power house for the United Railways & Electric Company, on Harford Ave., near North Ave., has been awarded to J. Henry Miller.

NEW ORLEANS, LA.—All of the physical property of the New Orleans Railways Company, under recently adopted reorganization plans, was sold at auction July 8 for $3,500,000. Mortimer Buckner, representing the New York Security & Trust Company, was the only bidder. This is the last technicality in the reorganization which reduced the capitalization from $80,000,000 to $60,000,000. The property is an amalgamation of all the street railroads in the city and of the electric light and gas plants.

KALAMAZOO, MICH.—At a meeting of the directors of the new Kalamazoo, Lake Shore & Chicago Railroad the following officers were elected: S. J. Dunkley, president; George E. Bardeen, vice-president; W. R. Beebe, treasurer, and James Grant, secretary.

BENTON HARBOR, MICH.—The Indiana & Michigan Electric Company, of South Bend, has contracted to furnish the Benton Harbor & St. Joseph Electric Railway & Lighting Company 3000 hp of electric energy for operating the street railway and street lighting system of the twin cities.

SAGINAW, MICH.—Articles of incorporation have been filed of the Saginaw & Southwestern Railway Company. The capital stock is $50,000. The line is to extend from Saginaw to St. Johns, a distance of 50 miles. At St. Johns it will connect with the Lansing Suburban Company's line. The directors of the new company are Albert S. Courtright, Lansing; W. G. Emerick, W. S. Linton, Edwin P. Waldron and Charles E. Linton, Saginaw. The business office will be in Saginaw.

GRAND RAPIDS, MICH.—A Grand Rapids Alderman has introduced into the Common Council an ordinance providing for a tax of 50 cents per annum on every street railway pole, electric lighting pole, telephone pole and telegraph pole in the streets of Grand Rapids. He proposes that all the poles in the city shall be painted green, and that stripes of distinctive hues should distinguished the poles of the different corporations. Each pole is to have a separate license, and each is to wear its license number.

BENTON HARBOR, MICH.—Articles of association have been filed by the Kalamazoo, Lake Shore & Chicago Traction Company, heretofore known as the Dunkley-Williams Company. The capital stock is $500,000, and the incorporators are: S. J. Dunkley, E. C. Dayton, W. R. Beebe, Kalamazoo; C. W. Williams, South Haven; George E. Bardeen, Otsego; A. W. Norton, Chicago; George L. Craig, Toledo; J. W. Thompson, Detroit; George T. Arnold, Mackinac Island; Joseph E. Lockwood, Detroit, and James Grant, Kalamazoo.

BENTON HARBOR, MICH.—The Michigan Cold Storage Company, which was to build an electric railway between Benton Harbor and South Haven and erect a cold storage and ice-making plant in this city, is tied up because of a break between President Fred M. Steele, formerly owner of the South Haven & Eastern, and Edmund F. Baird, his confidential agent and owner of the property on which the plants were to be built in this city. Work has been stopped and contractors ordered to render an accounting. Suit for $50,000 has been begun against Baird on a note endorsed by Steele, and other suits may follow.

NATCHEZ, MISS.—There is a movement on foot to construct an electric railway through Pike County, connecting Summit and Magnolia.

JEFFERSON CITY, MO.—The Mississippi Valley Electric Railway has been incorporated, with a capital of $650,000. The road will run from Kansas City to St. Joseph, with spurs extending to Leavenworth and Atchison. The length of the road will be about 65 miles. The board of directors will be composed of Charles P. Breen, George B. Tuggle, S. F. Wilson and H. B. McAfee, of Parkville, Mo., and George B. Blanchard, of New York City.

ST. LOUIS, MO.—Business men of St. Louis County have applied for a charter for an electric railway to connect Jefferson City with Valley Park, the route of which will pass through Eureka, Allenton, Pacific and intervening towns. J. F. Sensenbrenner, of Viola Heights, is one of those interested in the movement. M. D. Lewis, of Crescent Station, Dr. I. R. Monroe, of Eureka, and F. Merrylex, of Allenton, are also connected with the enterprise. It is planned to have the line connect with those already existing in St. Louis, while an extension to Kansas City is also proposed.

ST. LOUIS, MO.—The Chicago & Alton Railroad has installed in several of its stations on the St. Louis-Chicago lines an automatic electric device known as the train bulletin. It has the appearance of a large clock, a hand or pointer being moved on a dial, indicating whether the train is on time, or, if not, the number of hours or minutes late. These bulletins are placed in waiting rooms of stations and in the principal hotels of towns through which the company's trains are run. They are controlled by an operator in the depot. All bulletins register precisely similar records at the same instant. Considerable trouble is saved patrons and employes of the road by their use.

BROOKLYN, N. Y.—The Brooklyn Rapid Transit Company has opened a new trolley line from Ridgewood to the Manhattan end of the Williamsburg bridge.

ALBANY, N. Y.—The Auburn & Ithaca Traction Company, of Ithaca, has been incorporated to operate an electric street railway, 40 miles long, from Auburn to Ithaca. The capital stock is $400,000, and the directors are: Sherman Collins, Ithaca; E. B. Mosher and I. P. Hazard, Poplar Ridge.

TICONDEROGA, N. Y.—The Ticonderoga Union Terminal Railroad Company has been incorporated, with a capital stock of $50,000, to operate a street surface road five miles long from the Rutland Railroad at Addison Junction to Ticonderoga. The directors are I. Rothschild, A. B. Adkins and A. H. Weed, Ticonderoga.

NEW YORK, N. Y.—The Interborough Railway Company has filed with the Bureau of Franchises in the Finance Department applications for large extensions of its original routes in Bronx Borough. The action of the Aldermen temporarily prevents the Board of Estimate and Apportionment from acting, but it is probable that in time the company's applications will be granted. The lines are to be operated by the overhead trolley system. The Union Railway Company also has filed applications for extensions covering about 22 miles.

GLEN COVE, L. I., N. Y.—The Glen Cove Railroad Company, which operates a short line, has announced that it proposes to extend its line through several streets in Glen Cove and will also purchase a right of way from private owners for a trolley line to Sea Cliff, which is taken as an indication that the line will eventually reach Mineola and connect with the present system of the New York & Long Island Traction Company, now jointly owned by the Long Island Railroad Company and the Interborough Rapid Transit Company, of New York. Frank L. Fuller, manager of the New York & Queens County Railway Company, with offices in Long Island City, and also manager of the Belmont-Long Island trolley lines, is studying the situation in Nassau County, with the view of developing some of the franchises owned by the company and securing others. It is stated that the New York & Queens County Railway Company will begin this fall to build a line from College Point to Whitestone and Willets Point.

HICKORY, N. C.—The capital of the Hickory Railroad & Power Company has been increased from $125,000 to $300,000.

ASHEVILLE, N. C.—The Asheville & Craggy Mountain Railway Company will soon change from steam to electric power for the operation of the line from Asheville to a point on the French Broad River.

OBERLIN, OHIO.—The Oberlin & Lorain Railway Company has organized, with M. D. Skeels president, W. F. Stanley vice-president, C. R. Summers secretary and W. A. Donaldson treasurer.

NEWARK, OHIO.—A syndicate headed by B. G. Dawes, of Marietta, and M. G. Gillette, of this city, has taken over the property of the Citizens' Electric Light & Power Company of this city.

TOLEDO, OHIO.—The Toledo Railways & Light Company has purchased control of the Toledo & Point Place Electric Railway, which was opened a short time ago. The line is about two and a half miles long.

COLUMBUS, OHIO.—Officials of the Columbus, New Albany & Johnstown Interurban Line will soon award contracts for the extension of the line to Johnstown from its present terminus, Gahanna.

CLEVELAND, OHIO.—The reorganization committee of the Eastern Ohio Traction Company has recommended the sale of the property under foreclosure of the consolidated mortgage and the organization of the Cleveland & Mahoning Valley Traction Company to take over the properties.

COLUMBUS, OHIO.—It is announced that Tucker, Anthony & Co. are working on a plan for the consolidation of the Columbus, Buckeye Lake & Newark Traction Company and the Columbus, Newark & Zanesville Electric Railway. Both properties are owned by the same people and are under practically the same management.

STEUBENVILLE, OHIO.—The Steubenville & Wheeling Traction Company has increased its capital stock from $400,000 to $650,000. The additional capital will be used in changing the route of its line from Steubenville to Mingo Junction so as to avoid heavy grades, and possibly for the extension of the line south from Brilliant.

CINCINNATI, OHIO.—F. E. Seagrave, of Toledo; W. A. Calhoun, T. R. Smith and J. N. Gardner, of New York, are interested in a project to buy the Cincinnati, Georgetown & Portsmouth Railway and the Ohio River & Columbus Railway, the latter a steam road, and then build from Ripley to Aberdeen, where connection would be made with Maysville, Ky. From Maysville they propose to build to Mt. Olivet, Millersburg, Blue Lick Springs, connecting at Paris with the system of the Blue Grass Traction Company, making a continuous line from Lexington, Ky., to Cincinnati.

TOLEDO, OHIO.—The Patrick Hirsh Company, of this city, which is financing the Toledo, Ann Arbor & Detroit Railway, will shortly place contracts for the entire equipment. Contracts for the overhead work and grading have already been closed with the Fidelity Construction Company, of Detroit. The main power station will be located at Petersburg, Mich., for which the following equipment will be purchased: Two 750-hp cross-compound condensing engines with jet condensers, two 550-kw, 370-volt alternating current generators, four 300-h.p. boilers, a self-supporting steel stack, two 40-kw. exciters, and four 300 to 400-kw. rotary converter outfits, with other main station and sub-station equipment. There will also be purchased poles, ties and rails for 42 miles of track, seven passenger coaches, two express cars, one large steel bridge and fifteen to eighteen smaller ones, also equipment for a repair shop.

PITTSBURG, PA.—A charter has been requested for the Peters Creek Street Railway Company. W. G. Weimer, J. E. White and others are the incorporators.

CHAMBERSBURG, PA.—The Chambersburg & Gettysburg Electric Railway Company has decided to extend its system from this place to Greencastle, Middleburg and the state line; also to New Franklin and to Brown's Mills.

New Industrial Companies.

THE BEACON ELECTRIC COMPANY, of Boston, Mass., has been formed; capital, $25,000; president, Bradford L. Ames; treasurer, Fred S. Ashley.

THE SEASIDE ELECTRIC COMPANY, of Seaside, Ore., has been formed, with a capital of $1000. Dan J. Moore, A. S. Froslid and others are incorporators.

THE MERCHANTS' MOTOR COMPANY has been formed in Jersey City; capital stock, $200,000. The incorporators are: Albert H. Overman, Ward B. Chamberlain, Jr., and Albert B. Chamberlain.

THE AUTOMATIC TELEPHONE MANUFACTURING COMPANY has been formed at Augusta, Me., to manufacture telephones, etc.; capital, $200,000. President, L. J. Coleman, Gardiner; treasurer, W. S. Lee, Augusta.

THE ELECTRIC SALES CORPORATION, New York City, has been incorporated, with a capital stock of $10,000. The directors are H. L. Ferndon, Bergenfield, N. J.; F. H. Cordman and F. P. Reeve, of Brooklyn.

THE AMALGAMATED GAS FIXTURE COMPANY, of New York City, has been incorporated, with a capital of $45,000. The directors are R. R. Allen, Rockaway Beach; Bernard Sobely and Alfred Sear, New York.

THE AMERICAN NON-METALLIC STORAGE BATTERY COMPANY, of Jersey City, has been incorporated, with a capital stock of $125,000. The incorporators are Edward J. Burt, E. S. Cauldwell and James N. Davis.

THE ESSEX MOTOR CAR COMPANY, of Boston, Mass., has been incorporated with a capital of $100,000. President, Arthur Lovering; treasurer, Lawrence W. Cushman, both of Brookline; clerk, Frank D. Brannon, Cambridge.

THE CRESTMOOR MANUFACTURING & SUPPLY COMPANY, of New York, has been formed to develop mechanical and electrical appliances; capital, $50,000. Directors: R. L. Woolen, W. J. Robinson, New York, and Emma K. Chettle, Brooklyn.

THE NEW YORK COIL COMPANY, of New York City, has been incorporated to manufacture mechanical and electrical devices. The capital stock is $6,000. The directors are H. G. Mears, New York; A. A. Dittmar and William Roche, Jersey City.

THE CENTRAL ELECTRIC LAMP COMPANY has been incorporated at St. Louis; capital stock, $6,000. The incorporators are: Joseph Davey, George S. Johnson and L. A. Davey. The object of the corporation is to manufacture and deal in all kinds of electrical goods.

THE CANADIAN VALLEY ELECTRIC & REFRIGERATING COMPANY, of Holdenville and Weleetka, Okla., with a $100,000 capital stock, has been formed. Charles De Watterville, of Holdenville; M. D. Owen, of Chandler, and C. Porter Johnson, of Oklahoma City, are the incorporators.

THE SCHWAHN ALUMINUM COMPANY, of Belleville, Ill., has been incorporated with a capital stock of $2,500 to carry on a business of manufacturing, smelting, engineering and contracting. The incorporators are H. E. D. Schwahn, William Struthers and Gustave Schwahn.

THE MUNICIPAL OWNERSHIP LEAGUE OF NEW YORK, with principal offices in New York City, was incorporated with the Secretary of State July 8. The directors are J. G. Phelps Stokes, Samuel Seabury, Thomas A. Gilleran, John Palmieri, M. G. Palliser and M. F. Ihmsen, New York.

THE PALMER ELECTRICAL COMPANY, of Bangor, Me., has been organized to transact a general electrical business in the manufacture and sale of the Dyno-battery, etc., with $500,000 capital stock, of which $40 is paid in. The officers are: President, Charles D. Shaw, of Greenville; treasurer, R. M. Palmer, of Cambridge, Mass.

THE NORMAN MANUFACTURING COMPANY, of Hartford, Conn., has been formed by Harry L. McGregor-Norman, Jessie E. McGregor-Norman and Leroy S. Lewis. The capital stock is $25,000. The company will manufacture a new kind of machinery for lighting, heat and power. This will include both electrical and gas apparatus and machinery. Motors will be an important part of the products turned out.

Legal.

CHICAGO LEASES VALID.—Judge Julian W. Mack, in the Circuit Court at Chicago, has decided that the leases by which the Union Traction Company controls the street car lines of underlying companies are valid.

NEW JERSEY CORPORATION LAWS.—It has been decided by the New Jersey Court of Errors and Appeals that under the New Jersey corporation laws a company extending its corporate existence beyond the time specified by its original charter must pay the same fees as a new company. The decision was reached in the suit brought by the National Lead Company against Samuel D. Dickinson as Secretary of State, who refused to extend the company's charter for a nominal fee of $20, which, it is claimed, was all that was required. The company deposited $6,000 under protest. The money will be retained by the state.

FIXING TELEPHONE RATES.—The Supreme Court, sitting at Columbus, Ohio, on June 29, in the case of Farmer & Getz and the City of Salem against the Columbiana County Telephone Company, holds that a city cannot demand free telephones for itself nor fix rates. The State, under Sections 3454 to 2471-8, give power to construct lines in streets and public ways and not municipalities. The latter have only the power to agree as to the mode of use, and upon compensation for such use, but not beyond what may be necessary to restore the streets to former usefulness. Where such power to obtain free service and fix rates is attempted the company will not be required to adhere to them by a court of equity by mandatory injunction, even though it be shown that the rates agreed upon and incorporated in the ordinance were so fixed at the solicitation of the company.

Personal.

MR. A. F. RAMSEY, of Crawfordsville, Ind., has been elected vice-president of the New Long Distance Telephone Company, of Indianapolis.

MR. FRANCIS RAYMOND has resigned from the Stanley-G. I. Electric Manufacturing Company, at Chicago, to again engage as a manufacturer's agent.

MR. LOUIS HOLLWEG has been elected president of the Indianapolis Telephone Company and of the New Long Distance Telephone Company, to fill the vacancies caused by the recent death of S. P. Sheerin.

MR. GEORGE R. SELDEN, of Rochester, N. Y., has imported a radium clock from Europe that is receiving a good deal of attention from the press. It is guaranteed to run for 2,000 years, or the money will be refunded.

MR. H. B. SALE, secretary-treasurer of the Indianpolis Telephone Company, has been elected to the position of vice-president and general manager of the same company. Mr. Sale was also elected secretary of the New Long Distance Telephone Company.

MR. ARTHUR WILLIAMS, of the New York Edison Company and first vice-president of the National Electric Light Association, sails this week for Europe for a few months' rest and recreation. While abroad, however, he will look into the municipal ownership situation, a subject in which he is very much interested.

MR. M. B. BEATTIE has resigned his position with the General Electric Company and accepted a position with the Chicago office of the Crocker-Wheeler Co. Mr. Beattie was formerly connected with the power and mining department of the General Electric and had been stationed in its Detroit office.

MR. A. W. PROCTOR has become associated with Rosenbaum & Stockbridge, of New York City, in the practice of patent and trade-mark law. Mr. Proctor is an electrical engineer and an attorney-at-law. For the past seven years he has been an examiner in the U. S. Patent Office, at Washington, and is familiar with the electrical and other arts.

DR. ALBERTO PIRELLI, a member of the well-known house of that name, manufacturers of insulated wires and cables, etc., at Milan, Italy, is now on a visit to this country. Dr. Pirelli was over here last year as a member of the Italian delegation to the electrical congress and made a host of friends. He will spend about a month on this side.

MR. J. C. SLIPPY, of Waterloo, Ia., informs us that he has been placed in charge of the reconstruction of the plant of the Corn Belt Telephone Company (formerly under the United States Telephone Company) and that they will put in a thoroughly modern plant, with an ultimate capacity of 2400. A new building for the exchange will be erected, and about 30,000 feet of cable will be used.

MR. R. D. McGONIGLE, well known as a writer, philanthropist, clubman, lecturer, financier and promoter of sports, was found dead last week in the

Hotel Lincoln, at Pittsburg. He had killed himself with a dose of chloral. He was 53 years old, and a few years ago his fortune was estimated at several million dollars, but he had suffered big losses lately in speculation. He was the founder of the Allegheny Light Company, and was intimately connected with local illuminating interests.

REV. FATHER MURGAS.—An illustrated article appears elsewhere in this issue, describing the Murgas wireless telegraph system. Its inventor, the Rev. Father Murgas, was born in Tajo, Hungary, Feb. 17, 1864. After attending public school for six years, he went to college at Banska Bystrica for four years; then to Pressburg for two years, and Ostrihom for four years. In the latter two years of this he studied theology. He then went back to the first college, Banska Bystrica, for two more years, taking up theology again, and was ordained Nov. 10, 1888. Owing to his great artistic abilities, the Bishop sent him to Buda-Pesth to develop his talent for painting, and then to Munich, Bavaria, in 1889 and 1890. While in Vienna he became a member of the Electrotechnisches Verein, as during all his college life he had taken a great interest in electricity. He came to America in 1896, and has since been able to work to better advantage.

Trade Publications.

EARTHQUAKES.—The *Edinburgh Review's* learned and timely article on "Earthquakes and the New Seismology" is reprinted in *The Living Age* for June 24.

HABIRSHAW WIRES AND CABLES.—The India Rubber & Gutta Percha Insulating Company, Yonkers, N. Y., has just issued price-lists for White Core and Red Core wires.

OTTO GAS ENGINE WORKS, Philadelphia, Pa., are issuing excellent trade literature in the shape of a handsome reprint of "Some Reasons Why," being the brochure compiled for visitors to the St. Louis Exposition. It is admirably illustrated and full of good text, briefly put.

THE AITON MACHINE COMPANY has just issued its Bulletin No. 20, showing the three types of vertical stranding machines, for the manufacturing of small wire ropes and light cords. Copies of this bulletin can be obtained at the offices of the company, 126 Liberty St., New York City.

PROGRESS REPORTER.—The last issue of this publication contains an elaborate description of the Angus shops of the Canadian Pacific Railway. Practically all of the large machines were built by the Niles-Bement-Pond Company. Many of these are illustrated and discussed in detail.

MOTOR-CONTROLLING DEVICES.—The J. L. Schureman Company, 70 W. Jackson Boulevard, Chicago, is issuing a comprehensive loose-leaf catalogue devoted to automatic motor-controlling devices. These devices include self-starters, pressure regulators, tank switches, elevator controllers and requisite accessories.

ELECTRICAL SUPPLIES.—The Brode Electric Company, Los Angeles, Cal., has issued a comprehensive general catalogue No. 6, devoted to electrical apparatus and appliances, lighting, railway, house wiring, fire alarm, telephone and telegraph supplies. The catalogue contains 377 pages and is profusely illustrated throughout.

LIGHTING SPECIALTIES.—In a remarkably neat bulletin now being issued the Yost Electric Manufacturing Company, Toledo, Ohio, describes its line of electric lighting specialties, consisting of sockets, rosettes, bushings, shades, etc. The characteristic feature of these specialties is their high quality, which is a little beyond the standard required.

CIRCUIT BREAKERS.—In a well-written bulletin, the Cutter Company, Nineteenth and Hamilton Streets, Philadelphia, presents the arguments from a financial standpoint for the use of a circuit breaker. The advantageous features of circuit breakers in general and the "I. T. E." breaker in particular are pointed out, numerous illustrations serving to make the statements more emphatic.

HIGH-SPEED ENGINES.—In a miniature catalogue recently issued, A. L. Ide & Sons, Springfield, Ill., describe in detail the constructional features of the "Ideal" high-speed engine. The single-expansion engines are made in sizes from 8 to 400 horse-power, and the compound engines from 45 to 450 horse-power. The average efficiency of these engines is stated to be about 97 per cent.

FUSES.—The American Electric Fuse Company, Chicago, has issued a neat little folder containing a report by Prof. J. C. Kelsey, of Purdue University, on the satisfactory performance of a bank of arresters and Kaisling coils. The report states that the uniformity of action, completeness of operation, no sticking at all, ease of handling operated coils and convenience in getting at parts made a good impression.

THE LAMPOON.—Under the above title the Sterling Electric Manufacturing Company, Warren, Ohio, is publishing monthly an entertaining little magazine as the "Official Megaphone of the Society for the Prevention of Lost Candle Power and the Promotion of Real, Live, Honest Sterling Light." The publication is filled with well written short stories dealing for the most part with the subject of illumination.

CALCULAGRAPH.—One of the most interesting mechanical devices for assisting in the accurate determination of the time spent upon piece work in factories is found in the "calculagraph," which serves to record both the time of beginning work and the elapsed time when the work is completed. The features of this valuable little instrument are outlined in a pamphlet recently issued by the Calculagraph Company, 1425 Jewelers' Building, New York City.

LARGE GAS ENGINES—In an attractive catalogue, the De La Vergne Machine Company, East 138th St., New York, outlines the constructional features and operating characteristics of the Koerting two-cycle gas engine. The catalogue is well illustrated. One of the interesting views shows five of sixteen 2000-h.p. two-cycle gas engines operating blowing engines at the Buffalo works of the Lackawanna Steel Company. These engines operate on blast-furnace gas. A valuable feature of the catalogue is found in the technical discussion of the advantages to be derived from the utilization of blast-furnace gas. In discussing the performance of the gas engine it is stated that under the most favorable conditions the thermal efficiency obtained by the Koerting engine is 38 per cent., based on the indicated horse-power.

ELECTRIC GRINDERS AND BUFFERS.—The Northern Electrical Manufacturing Company, Madison, Wis., has recently issued a well illustrated catalogue, designated as Bulletin No. 48, which is devoted to electric grinders and buffers. Each machine consists of an enclosed electric motor, on the extended shaft at each end of which is mounted an emery grinder or buffer. The grinders are of special design and construction, including heavy, crucible, tool-steel, armature shafts, liberal bearings and dust-proof covers. The motors are equipped with speed-regulating devices, so that the speed of the grinding and buffing wheels can be varied to compensate for the varying diameters of the wheels.

THE PARKER BOILER.—The Parker Boiler Company, Philadelphia, Pa., has issued a descriptive catalogue devoted to its water-tube boiler. The characteristic feature of this boiler resides in the use of tubes without bends, so that any scale which forms can be readily removed. The flow of water is so arranged that the scale is carried downward automatically until the upcast is reached, where the flow is so rapid that it sweeps all before it. The coolest water enters the upper end of the element, where it comes in contact with the coolest gases, and since there is a considerable difference in temperature between the two, there is obtained a transfer of heat which insures a high efficiency.

News of the Trade.

MR. J. B. WILSON, formerly with the Woodill & Hulse Electric Company, Los Angeles, Cal., has opened an establishment in Canton, Ohio, where he will conduct a business of electric wiring, etc.

THE CHANDLER & TAYLOR MANUFACTURING COMPANY, of Indianapolis, Ind., has secured the contract to build and install the 150-hp. high-speed, self-oiling engine in the new power plant in the department store of Mandel Bros., in Chicago.

THE LAFAYETTE ELECTRIC MANUFACTURING COMPANY, Lafayette, Ind., recently incorporated to manufacture transformers under the management of Mr. William H. Hornberger, is about ready for business. The company will manufacture the Hornberger transformer in various sizes for electric lighting and electric railway work. The company has installed its machinery in a large three-story brick building and will have its products on the markets in a few days.

FRANKLIN LAMP CONFERENCE.—The usual annual conference of the selling organization of the Franklin Electric Mfg. Co., of Hartford, Conn., was held in that city on June 27, 28, 29, 30, when an enjoyable and useful meeting was had. The list of conferees included C. I. Hills, J. Camp, E. D. Redfield, J. W. Morrell, E. B. Hatch, J. A. Butler, P. S. Klees, G. O. Curtis, C. N. Thorpe, F. E. Wilson, C. Leonard, H. A. Truitt, T. G. Truitt, I. M. Johanson, J. D. Morrell, D. S. Morrell. A banquet was given on the last night, and the regular proceedings were interspersed with sundry entertainments.

FIRE IN DALE FACTORY.—A very destructive fire occurred a few days ago in the large building at Ninth Avenue and West Thirteenth Street, in which the factory of the Dale Electrical Company was located. Before the fire could be subdued some forty firemen were badly incapacitated by smoke and back draft. Mr. John Dale had just been taking inventory of his large stock, on which the loss is estimated to have run as high as $100,000. Fortunately, the insurance is ample, and Mr. H. S. Salt, the manager, informs us that the manufacturing plant is already in such shape that they will be turning out goods again in ten days. Of course, they are not yet in shape to make deliveries of orders on hand, but every effort is being made to cope with the situation.

CRANE COMPANY'S FIFTIETH ANNIVERSARY.—The Crane Company, Chicago, celebrated its fiftieth anniversary July 4. All of the company's branch house managers took part in the celebration. On Monday the branch house managers went through the Crane Company's factories. In the evening at 7 o'clock they were given a dinner and taken to the "White City." Tuesday morning the managers went to Lake Geneva, Wis., where they were entertained by Mr. R. T. Crane at his summer residence then and the following day. Thursday, July 6, the company gave to all its employes and their families a picnic at Northwestern Park. About 10,000 people attended this picnic. As a souvenir of the anniversary the company is furnishing to any one in the trade a metal elephant, to be used as a paper weight. These elephants may be obtained upon application at any of the branch houses or to the general offices in Chicago.

LIGHTING AND POWER UNITS FOR EXPORT.—Even at the present time there are comparatively few concerns in America that build both the engine and the generator. Prominent among these is the B. F. Sturtevant Co., of Boston, Mass., U. S. A. It is certainly a misfortune that its world-wide reputation as blower manufacturer has partially obscured the magnitude of its business in engines, motors and generating sets. In fact, however, the B. F. Sturtevant Co. has for years made a specialty of high grade generating sets, with the engine and generator designed each for the other, and combining maximum efficiency with minimum space and weight; elements which are particularly essential in machinery built for export. This company now catalogues no less than thirty-six different sizes and types of units ranging from 3 to 100 kilowatts. Each is absolutely complete in its parts, being carried upon a bedplate which is common to both. The size and weight of all but the larger sizes are such as to permit of export shipment without separating of parts, so that the machine stands ready for operation as soon as it is unpacked.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JULY 4, 1905.

[Conducted by Rosenbaum & Stockbridge, Patent Attys., 140 Nassau St., N. Y.]

793,647. CAPACITY; Reginald A. Fessenden, Washington, D. C. App. filed Dec. 14, 1904. (See page 90.)

793,648. RECEIVER FOR ELECTROMAGNETIC WAVES; Reginald A. Fessenden, Washington, D. C. App. filed Dec. 14, 1904. (See page 90.)

793,649. SIGNALING BY ELECTROMAGNETIC WAVES; Reginald A. Fessenden, Washington, D. C. App. filed March 30, 1905. (See page 90.)

793,650. SIGNALING BY ELECTROMAGNETIC WAVES; Reginald A. Fessenden, Washington, D. C. App. filed March 30, 1905. (See page 90.)

793,651. AERIAL FOR WIRELESS SIGNALING; Reginald A. Fessenden, Washington, D. C. App. filed March 30, 1905. (See page 90.)

793,652. SIGNALING BY ELECTROMAGNETIC WAVES; Reginald A. Fessenden, Washington, D. C. (App. filed April 6, 1905. (See page 90.)

793,671. ELECTRIC AUTOMATIC BLOCK SYSTEM FOR RAILWAYS; George H. Lower, Robert H. Lower, Edward P. Lower, Winfrey W. Lee, William B. Lee and Herbert Walker, Hot Springs, Ark. App. filed July 23, 1904. A tappet adjacent to one of the track rails is moved laterally by the passage of a train, and closes a circuit to energize a solenoid and set semaphore to danger. A release magnet is operated by contacts closed at the succeeding tappet in the next block section.

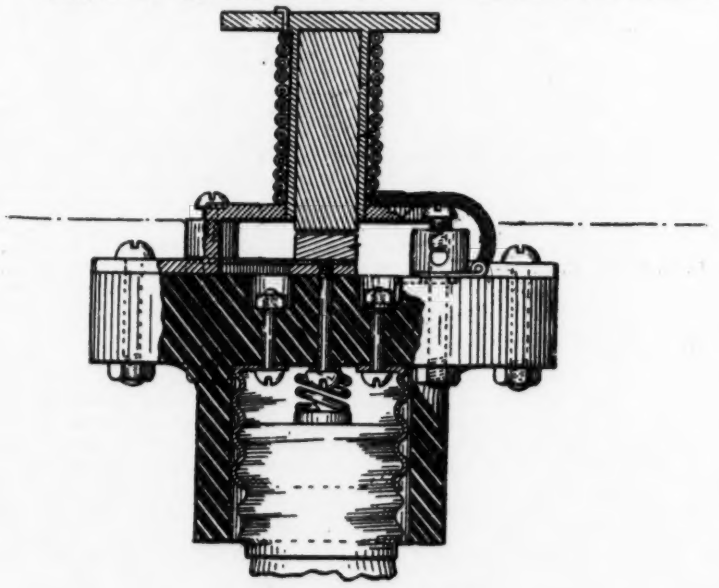
793,718. WIRELESS TELEGRAPHY; Reginald A. Fessenden, Washington, D. C. App. filed March 30, 1905. (See page 90.)

793,754. INSULATION. George A. Weber, New York, N. Y. App. filed Feb. 10, 1903. An insulating bushing for bolts comprising a pair of sheet metal cups which are nested concentrically with one another and include an insulating substance between them.

793,760. ART OF TELEGRAPHY. Marcus O. Anthony, Barberton, O. App. filed Nov. 22, 1902. A transmitting induction coil has windings by which currents are induced in both directions by the make-and-break action of the transmitting key. The alternating impulses pass over a single line wire and are received in a second "step-down" coil of special construction.

793,768. MOTOR CONTROL; Eugene R. Carichoff, East Orange, N. J. App. filed Dec. 8, 1903. An operating circuit produces movements of a main switch operating solenoid core. At one position of the main switch the motor is connected to the supply mains, and at the other position the armature windings are short-circuited through the field coils to energize them with normal polarity so as to produce a magnetic brake.

793,774. MULTIPLE ELECTRIC LAMP HOLDER. Elias L. Elliott, New York, N. Y. App. filed June 5, 1903. A hemispherical cup of insulating



793,935.—Lamp Socket.

material has an annular ring therein to which is attached a pair of the lamp sockets. The third socket is specially connected so that all are in series in normal operation.

793,775. FIRE AND BURGLAR ALARM. Peter M. Esser, Chicago, Ill. App. filed Aug. 29, 1904. A cord is led to various points around the dwelling to be protected, and lateral extensions to various points serve to pull the cord and close an alarm circuit when windows or doors are opened. In case of fire the cord burns and another alarm circuit is closed.

793,777. CONDENSER; Reginald A. Fessenden, Washington, D. C. App. filed March 30, 1905. (See page 90.)

793,802. ELECTRIC PROTECTIVE APPARATUS. Frederick R. Parker, Chicago, Ill. App. filed July 9, 1904. A combined lightning arrester and "sneak current" protector in which carbon blocks are included in the circuit and slightly separated so as to leave a jump gap for lightning discharges. A pair of spring circuit closing blades are normally held apart by a thermal protector and serve to short-circuit the line conductors under the action of the sneak currents on the thermal protectors.

793,845. AUTOMATIC TAKE-UP DEVICE FOR TELEPHONE CONNECTIONS. Frank B. Long, Los Angeles, Cal. App. filed Oct. 15, 1904. The telephone receiver is hung on a flexible strap or band in which is embedded the conductor. When released the band is automatically wound on a spring reel. The circuit is made through conducting rings and brushes.

793,848. ELECTRIC CONTROLLER. Charles S. Reno, Covington, Ky. App. filed March 11, 1905. The controller arm contains two cams thereon, one of which closes the motor circuit in either direction, and in such a way as to give a quick make-and-break thereof, while the other cam is effective to cut resistance coils gradually in and out of the circuit.

793,872. SPARK TIGHT BOX FOR ARC LAMPS. Harry Bissing, New York, N. Y. App. filed May 23, 1904. Comprises a sheet metal casing having a wire gauze transparent front, and lateral doors for the inspection of the arc. Switches are provided so that the arc cannot be struck until all of the doors are tightly closed.

793,881. SECONDARY BATTERY; Isidor Kitsee, Philadelphia, Pa. App. filed March 17, 1893.

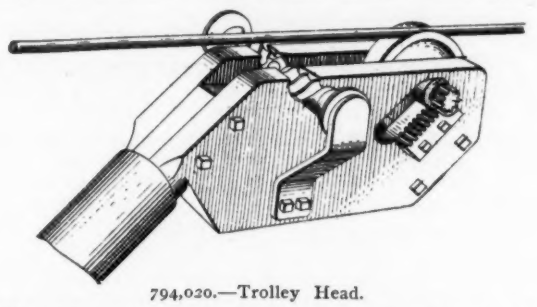
793,897. ELECTRIC SWITCH SYSTEM FOR BLAST FURACES; Robert G. McFarland, Newcastle, Pa. App. filed Nov. 10, 1904.

793,904. INDUCTION MOTOR; William D. Pomeroy, Norwood, O. App. filed Nov. 24, 1903. The rotary windings are initially connected to conductor rings from which the induced current is led through resistances in order to increase the starting torque of the motor. When the motor arrives at full speed a cam is thrown into action which short-circuits the conductor rings.

793,928. TELEPHONE TRANSMITTER; William E. Harkness. Elyria, Ohio. App. filed March 18, 1904.

793,935. LAMP SOCKET; Walter J. Jones, Newark, N. J. App. filed May 24, 1904. A lamp socket for series incandescent lamps in which an exceedingly minute spark-gap normally opens a shunt circuit. When the filament breaks the rise in potential causes the current to jump the gap and energizes a cut-out magnet.

793,936. ELECTRIC PUSH BUTTON; Henry F. Keil, Bronxville, N. Y. App. filed Feb. 27, 1905. A floor push button having certain detail features of construction relating to the cup-shaped casing of sheet metal and the



794,020.—Trolley Head.

disposition of the contact plates in an insulating plug at the bottom thereof.

793,941. TELEPHONE EXCHANGE SYSTEM; Edmund Land, Grand Rapids, Mich. App. filed Jan. 23, 1903.

793,952. ELECTRICAL LAMP FIXTURE; Benjamin W. Perrigo, Auburn, N. Y. App. filed Nov. 3, 1904. The insulating ring between the canopy and the ceiling is formed of overlapping sections, any one of which may be replaced when broken or injured without removing the central fixtures.

793,965. TROLLEY; William F. Thompson, Corapolis, Pa. App. filed Dec. 28, 1904. The trolley harp carries a pair of rubber-coated spring hooks which close over the trolley wire, but are displaced laterally to pass an obstruction. The trolley wheel is vertically movable in the harp.

793,969. SWITCH; Ferdinand Volk, Pittsburg, Pa. App. filed Nov. 25, 1904. The trolley wire is supported from a frame which also carries a revolvable commutator or switch. A tappet in the path of the trolley wheel operates a ratchet pawl to step around the commutator and close the switch-operating circuits.

793,971. TELEPHONE EXCHANGE SYSTEM; Harry G. Webster, Chicago, Ill. App. filed April 17, 1903.

793,972. TELEPHONE EXCHANGE SYSTEM; Harry G. Webster, Chicago, Ill. App. filed March 25, 1903.

794,011. ATTACHMENT FOR EXPLOSIVE ENGINES; William B. Hayden, New York, N. Y. App. filed Oct. 22, 1904. The magneto generator is driven from a coil spring which is wound up by a ratchet pawl operated from the engine. A centrifugal governor disconnects the rewinding means when sufficient speed of the generator is attained. The generator may be initially rotated by its spring before the engine starts so as to furnish the starting ignition of the engine.

794,012. ELECTRIC TEMPERATURE ALARM; Cowan P. Hepler, Smithton, Pa. App. filed Feb. 6, 1905. A mercury thermometer has platinum electrodes fused into the glass so that an alarm circuit may be made for any desired temperature in the usual way. A mercury jacket surrounds the platinum to prevent oxidization thereof by the chemicals treated.

794,016. TELEPHONE ATTACHMENT; Frank F. Howe, Marietta, Ohio. App. filed March 2, 1905.

794,020. TROLLEY HEAD; Harry I. Jeffers, Tuscaloosa, Ala. App. filed August 20, 1903. The trolley harp has laterally projecting spirally grooved inclined rollers to guide the wire to central position, and the trolley wheel drops when freed from the wire so that it is in position to again receive the wire when guided thereto by the spiral rollers.

794,022. DRAFT-DRIVEN GENERATOR; William Henry Jordan, Hays, Kan. App. filed March 8, 1905. (See Current News and Notes.)

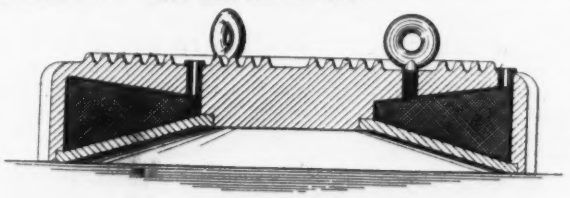
794,086. LIFTING MAGNET; Arthur C. Eastwood, Cleveland, O. App. filed Dec. 27, 1904. Specially adapted for scrap and small cast-iron articles. The magnet is very flat and as widely separated annular pole faces so as to produce a field which extends deeply into the mass to be lifted. The energizing coil is of triangular section for a special purpose.

794,084. METER; Frederick Darlington, Great Barrington, Mass. App. filed Oct. 14, 1904. A copper disc is rotated by clockwork and attains a certain speed under no-current conditions. Series and shunt damping magnets in the circuit to be measured slow down the rotation of the disc and the current is calculated from the amount that its rotation is arrested.

794,116. TELEPHONE ATTACHMENT; Valentin Rebhun, Schaghticoke, N. Y. App. filed Oct. 17, 1904.

794,125. SERVICE METER FOR TELEPHONE LINES; Charles E. Scribner and James L. McQuarrie, Chicago, Ill. App. filed July 16, 1900.

794,134. TELEPHONE SWITCH; Klas Weman and Henry Melvin Bascom, New York, N. Y. App. filed Oct. 16, 1903.



794,086.—Lighting Magnet.

794,135. INDUCTION MOTOR; Edwin C. Wright, Newport, Ky. App. filed Nov. 24, 1903. A form of induction motor in which the windings are short-circuited after the motor arrives at normal speed by means of three brushes which are moved into short-circuiting relation by three sprocket wheels operated by a single sprocket chain and cam.

794,137. TELEPHONE RECEIVER; Theodore C. Brecht, Washington, D. C. App. filed Sept. 22, 1902.

794,142. TELEPHONE SWITCHBOARD; Eugene Darnell, Carrollton, Mo. App. filed April 30, 1904.

794,140. SOCKET OR RECEPTACLE PLUG; Louis J. Costa, Philadelphia, Pa. App. filed April 16, 1904. A lamp socket for exposed positions in which a rubber packing washer is clamped into packing relation when the socket parts are screwed together so as to exclude damp and moisture from the metallic surfaces.